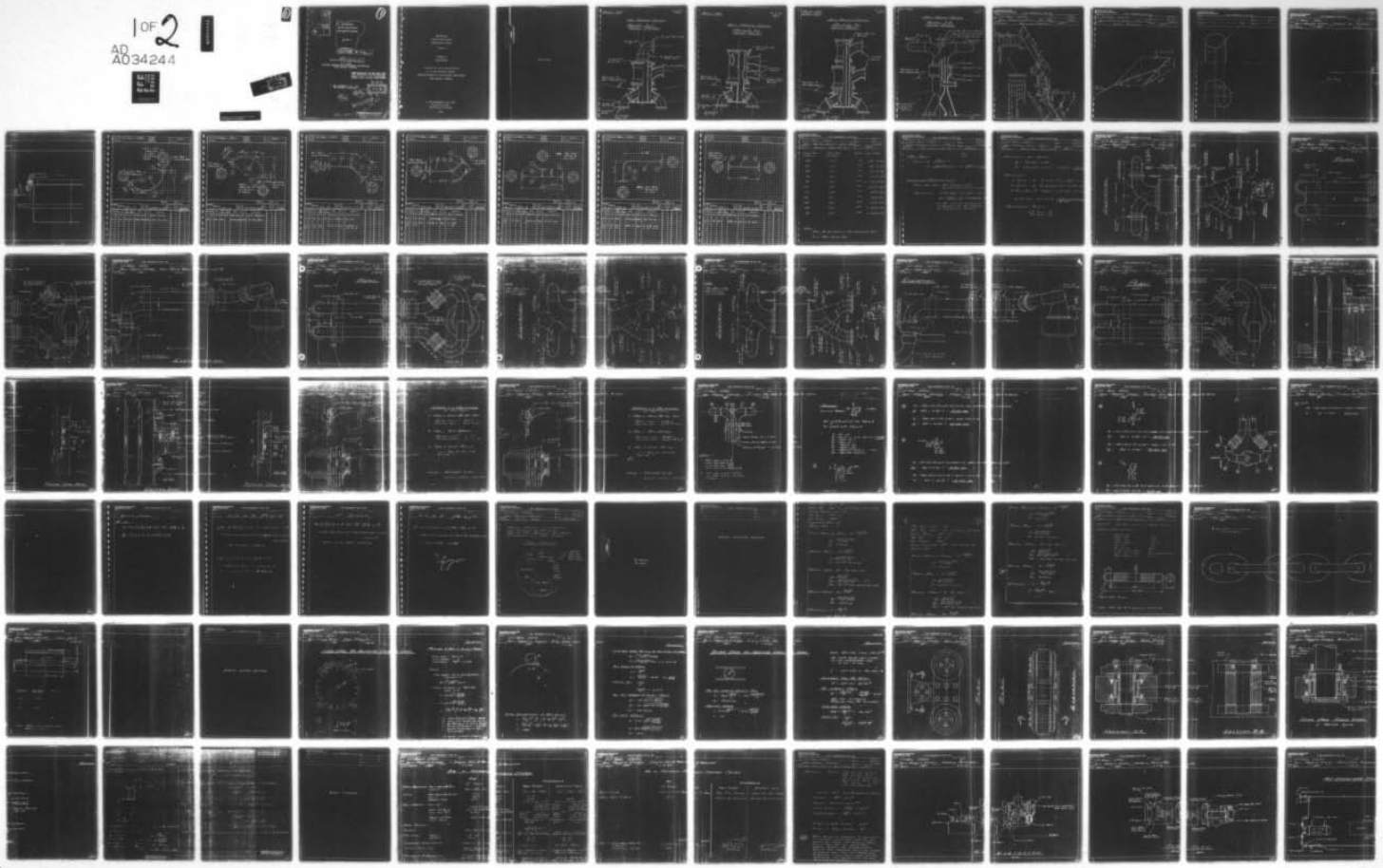
AD-A034 244 MCDERMOTT (J RAY) CO INC NEW ORLEANS LA F/G 13/10
ENGINEERING DESIGN CALCULATIONS MONO-MOORING SYSTEM. VOLUME 3. --ETC(U)
1966 DA-44-009-AMC-841(T)

UNCLASSIFIED NL

1 OF 2
AD
A034244



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MONO-MOORING SYSTEM.

VOLUME 3.

APPENDIX A.
TO
(9) FINAL REPORT, DM Phase 1.

(15) Contract No. DA-44-009-AMC-841(T)

U. S. ARMY
ENGINEER RESEARCH AND DEVELOPMENT LABORATORIES
FORT BELVOIR, VIRGINIA

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J. RAY McDERMOTT & CO., INC.
NEW ORLEANS, LOUISIANA

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MONO-MOORING SYSTEM

VOLUME 3

APPENDIX A
to
FINAL REPORT

Contract No. DA-44-009-AMC-841(T)

U. S. ARMY MATERIEL COMMAND

ENGINEER RESEARCH AND DEVELOPMENT LABORATORIES

FORT BELVOIR, VIRGINIA

J. RAY McDERMOTT & CO., INC.
Saratoga Building
New Orleans, Louisiana

1966

SECTION I

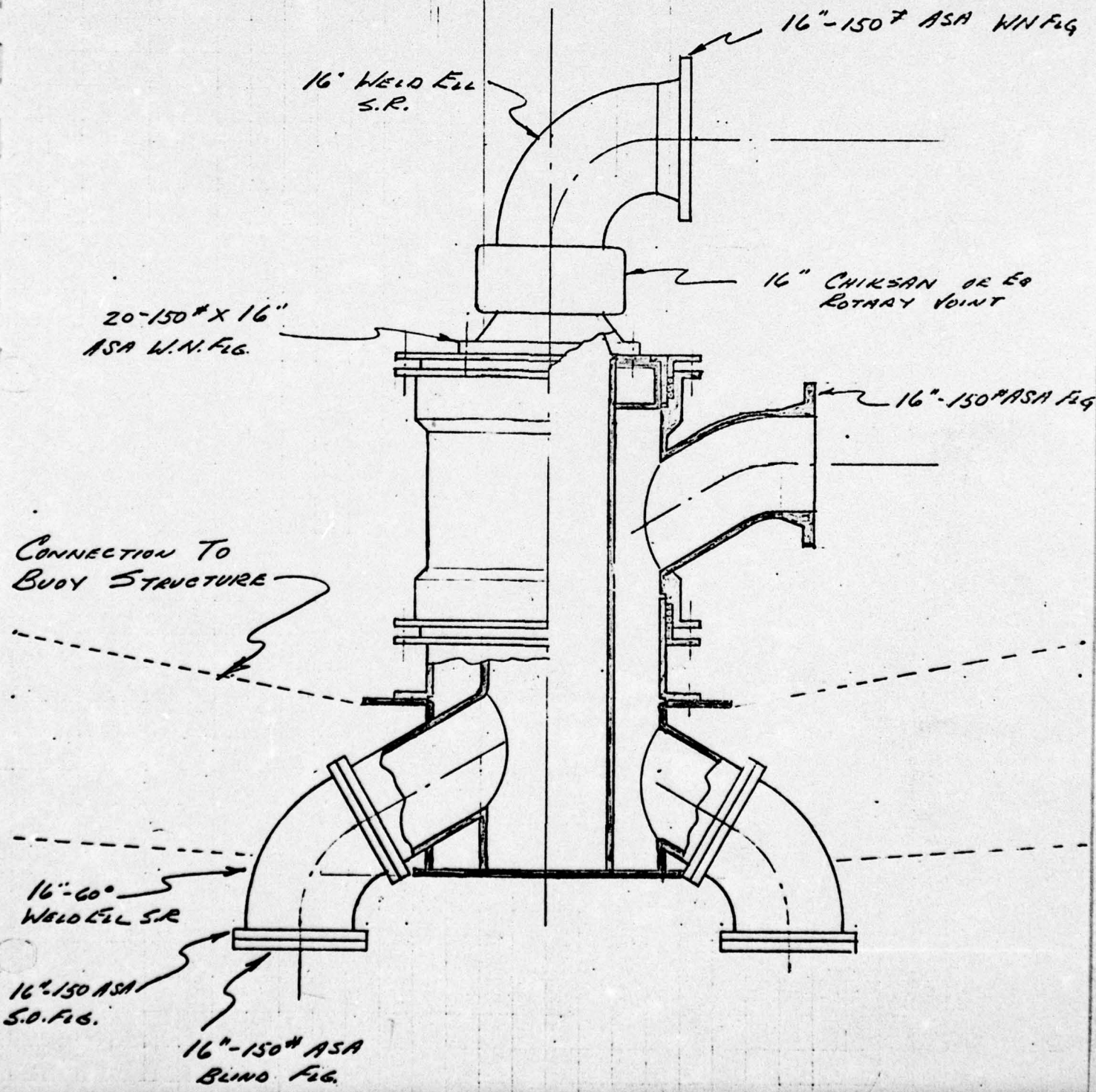
SWIVEL DESIGN

PROJECT 2971

12-10-64
WAP

MONO MOORING SYSTEM

PROPOSAL # 1
SWIVAL DESIGN

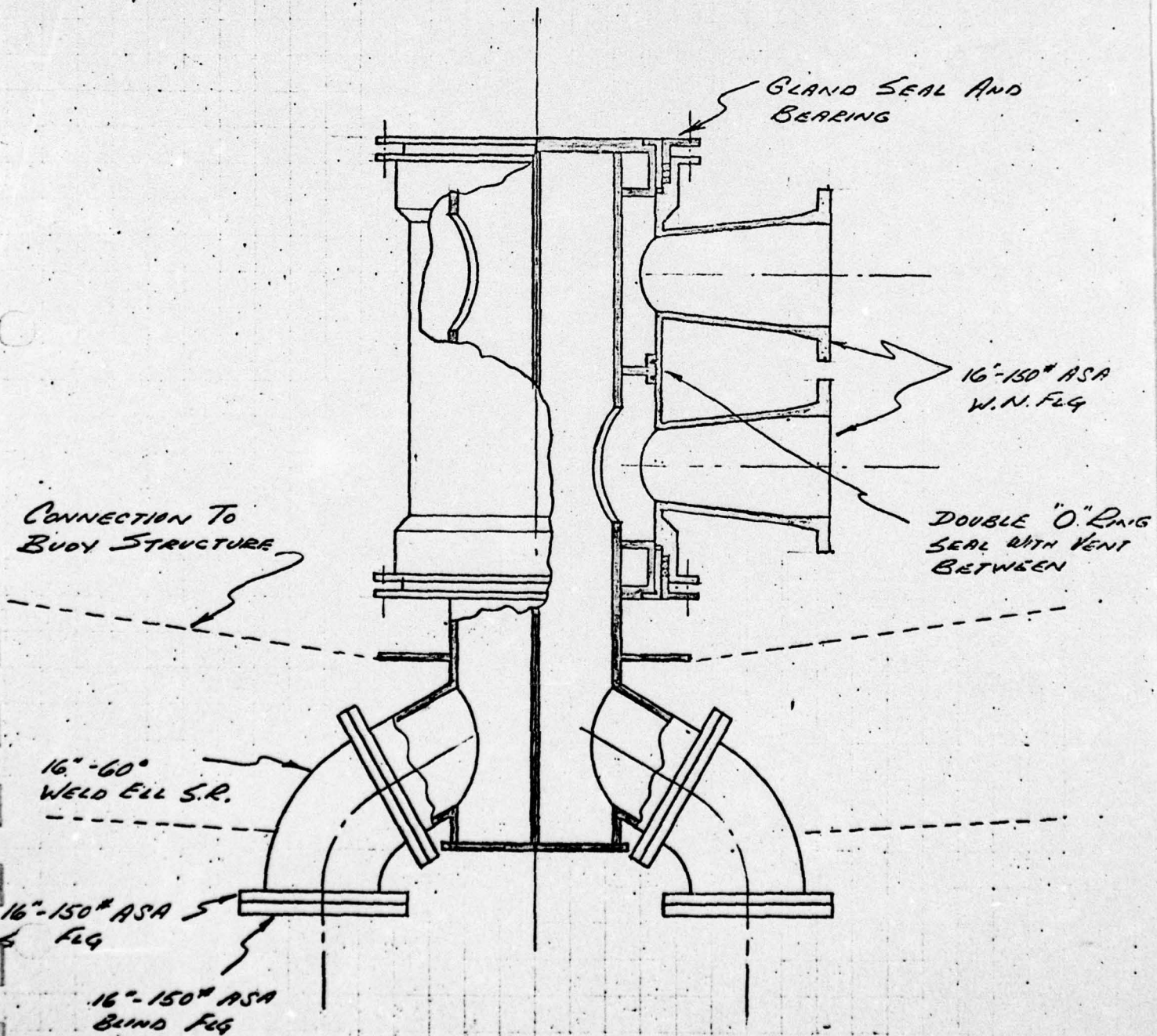


PROJECT 2971

12-11-64
WAP

MONO MOORING SYSTEM

PROPOSAL #2
SWIVEL DESIGN

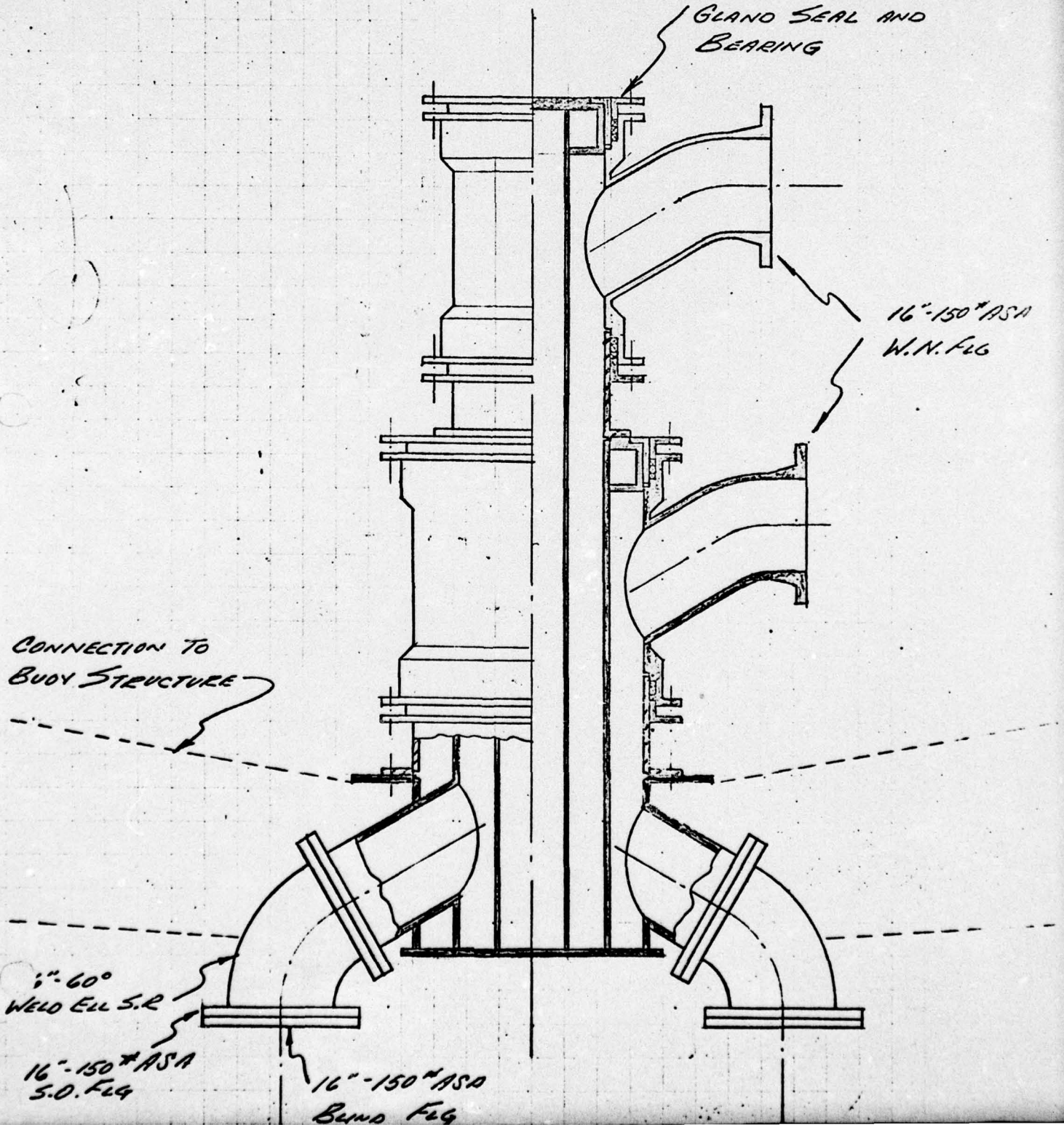


PROJECT 2971
V&B ORDER 56017

12-14-61
WHF

MONO MOORING SYSTEM

PROPOSAL #3
SWIVEL DESIGN

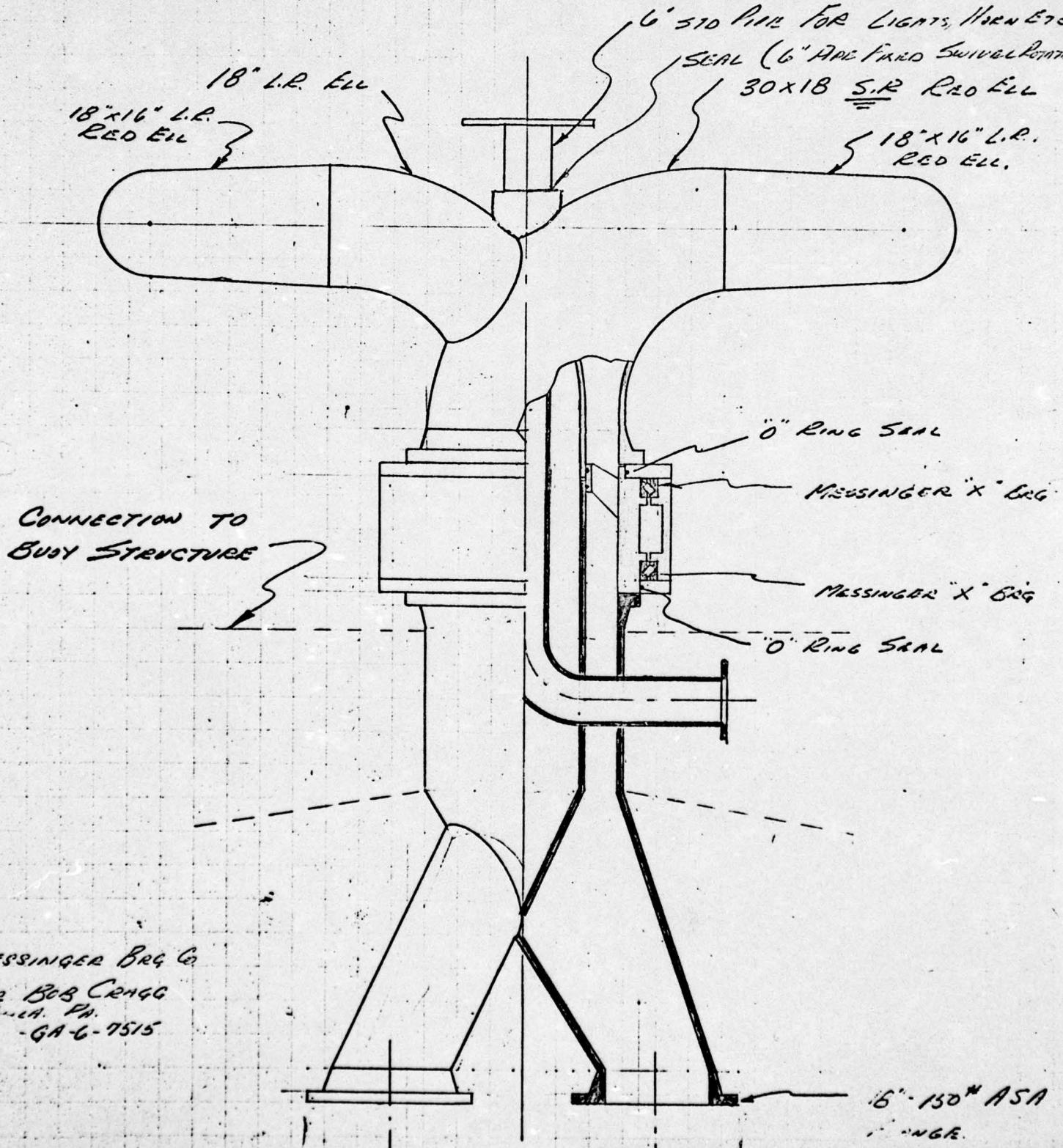


PROJECT 2971

1-11-65
WM

MONO MOORING SYSTEM

PROPOSAL # 4
SWIVEL DESIGN

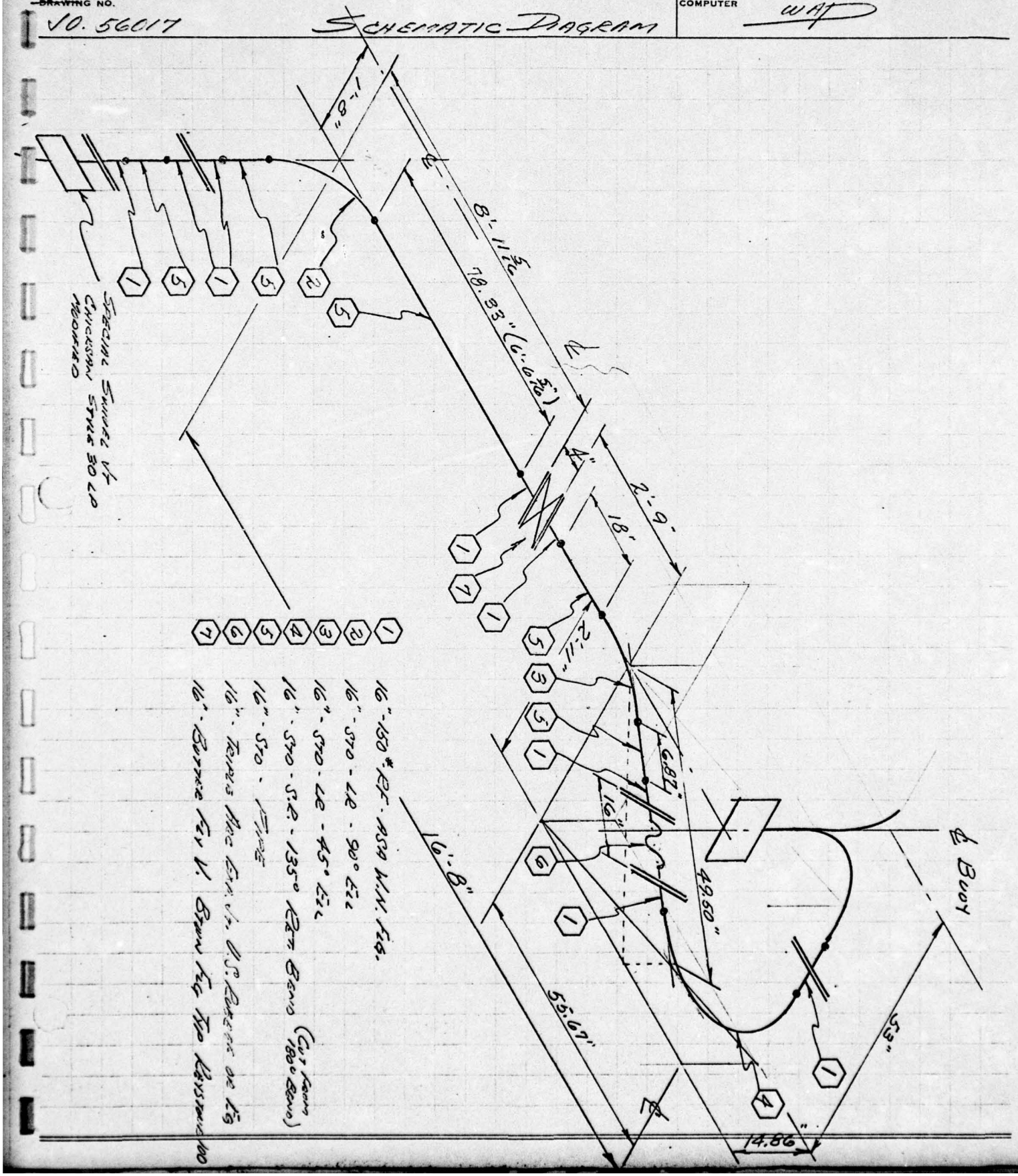


MESSINGER BRG CO.
MR BOB CRAGG
PHILA. PA.
-GA-6-7515

COMPUTATION SHEET
ENGINEERING DEPARTMENT
McD 5011

J. RAY McDERMOTT & Co., INC.

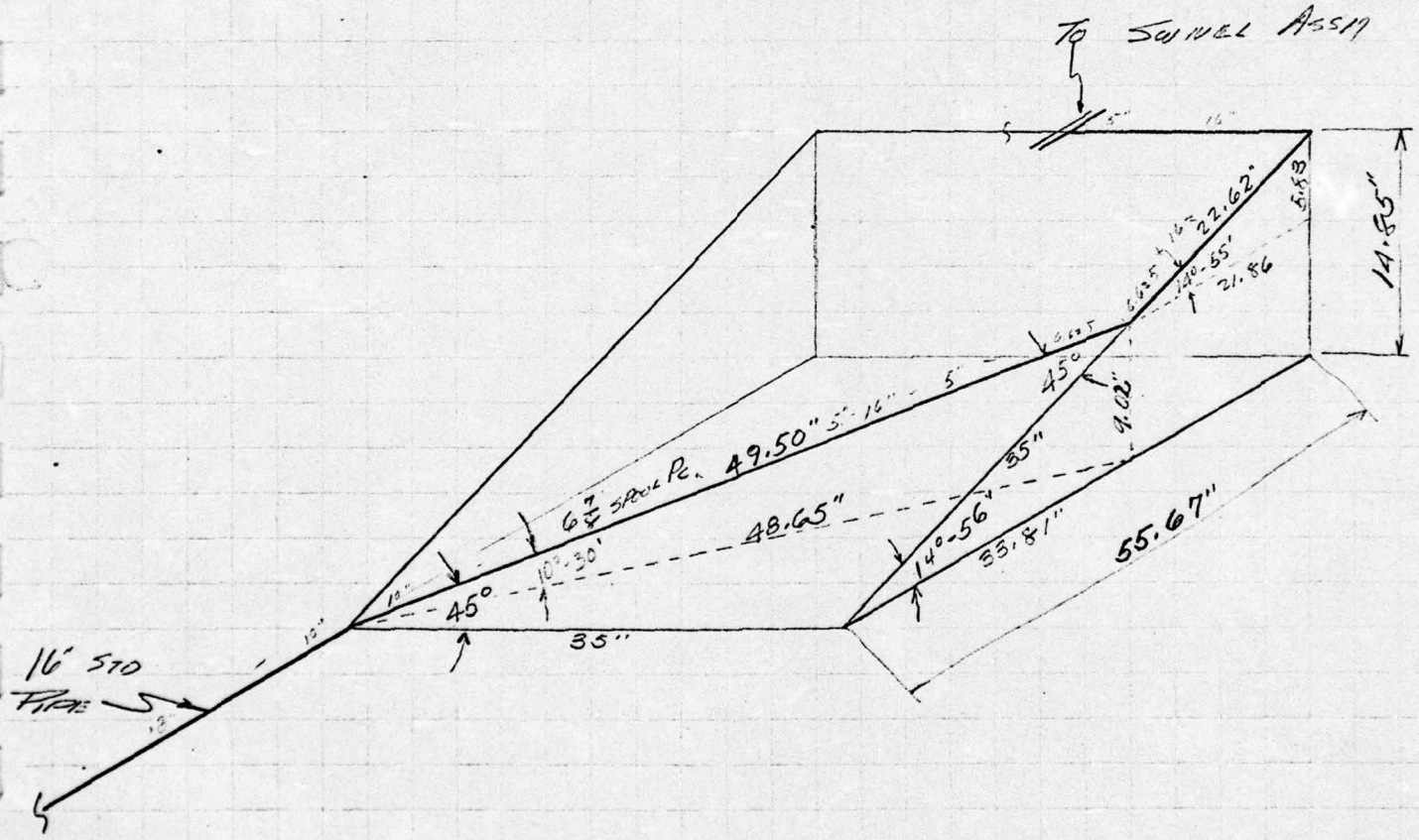
COMPANY	FIELD	SHEET NO.
U.S. ARMY - ERDL		24
PROJECT	WELL NO.	DATE
MONO MOORING SYSTEM - DECK PIPING		6/29/65
DRAWING NO.	COMPUTER	
NO. 56017	SCHEMATIC DIAGRAM	WAT



COMPUTATION SHEET
ENGINEERING DEPARTMENT
MCO 5011

J. RAY McDERMOTT & CO., INC.

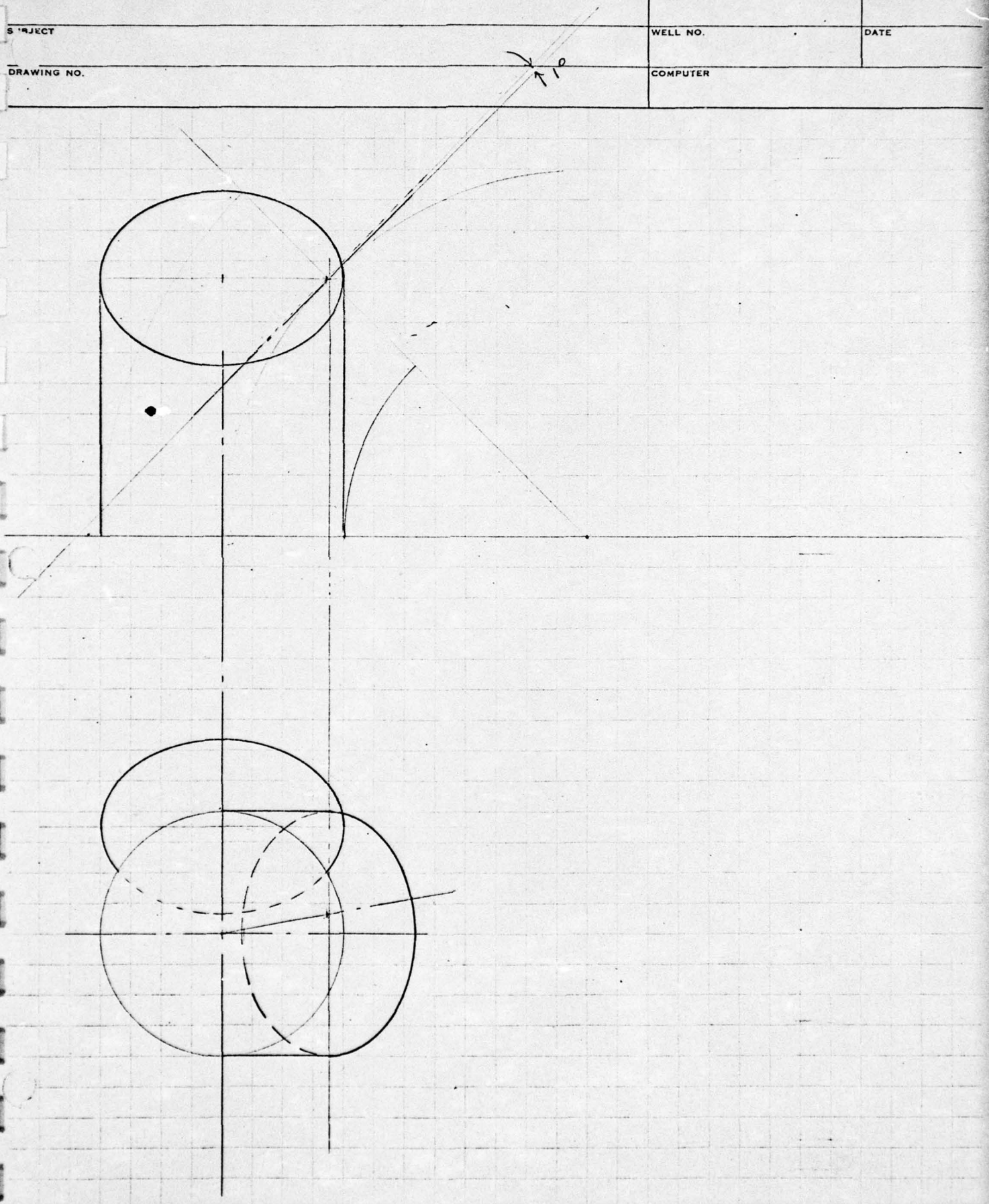
COMPANY	FIELD	SHEET NO.
U.S. ARMY - ERDL		1 of
SUBJECT	WELL NO.	DATE
MONO MOORING SYSTEM - DECK PIPING		4/22/65
DRAWING NO.	COMPUTER	
OFFSET DIAGRAM	WHP	



COMPUTATION SHEET
ENGINEERING DEPARTMENT
McD 5011

J. RAY McDERMOTT & CO., INC.

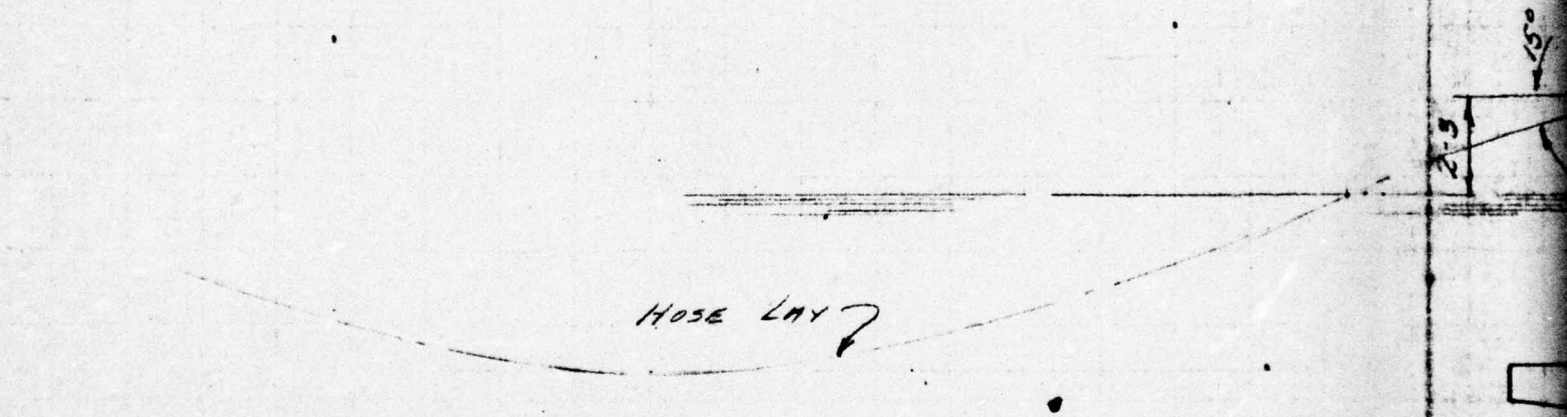
COMPANY	FIELD	SHEET NO.
SUBJECT	WELL NO.	DATE
DRAWING NO.	COMPUTER	

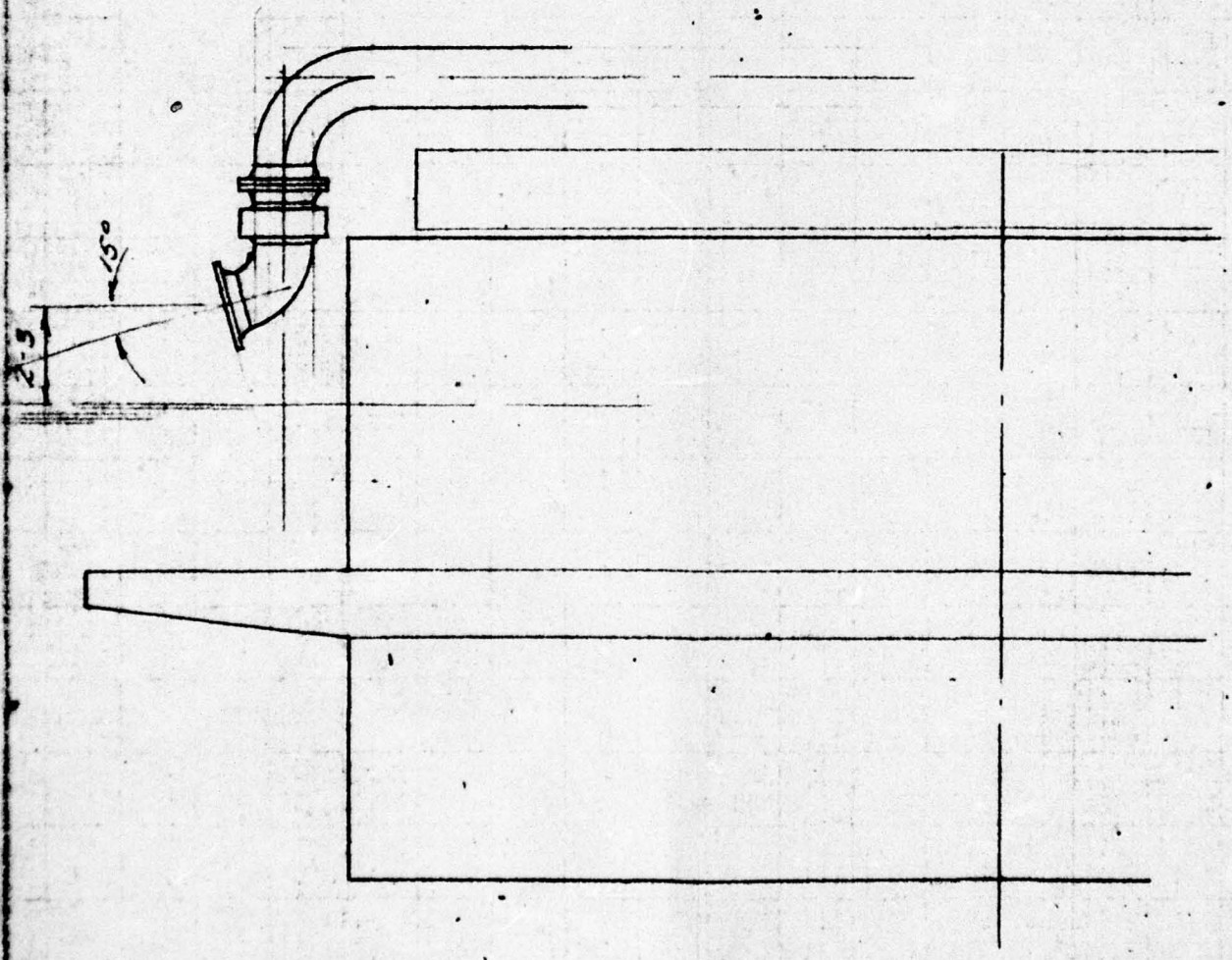


ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5036

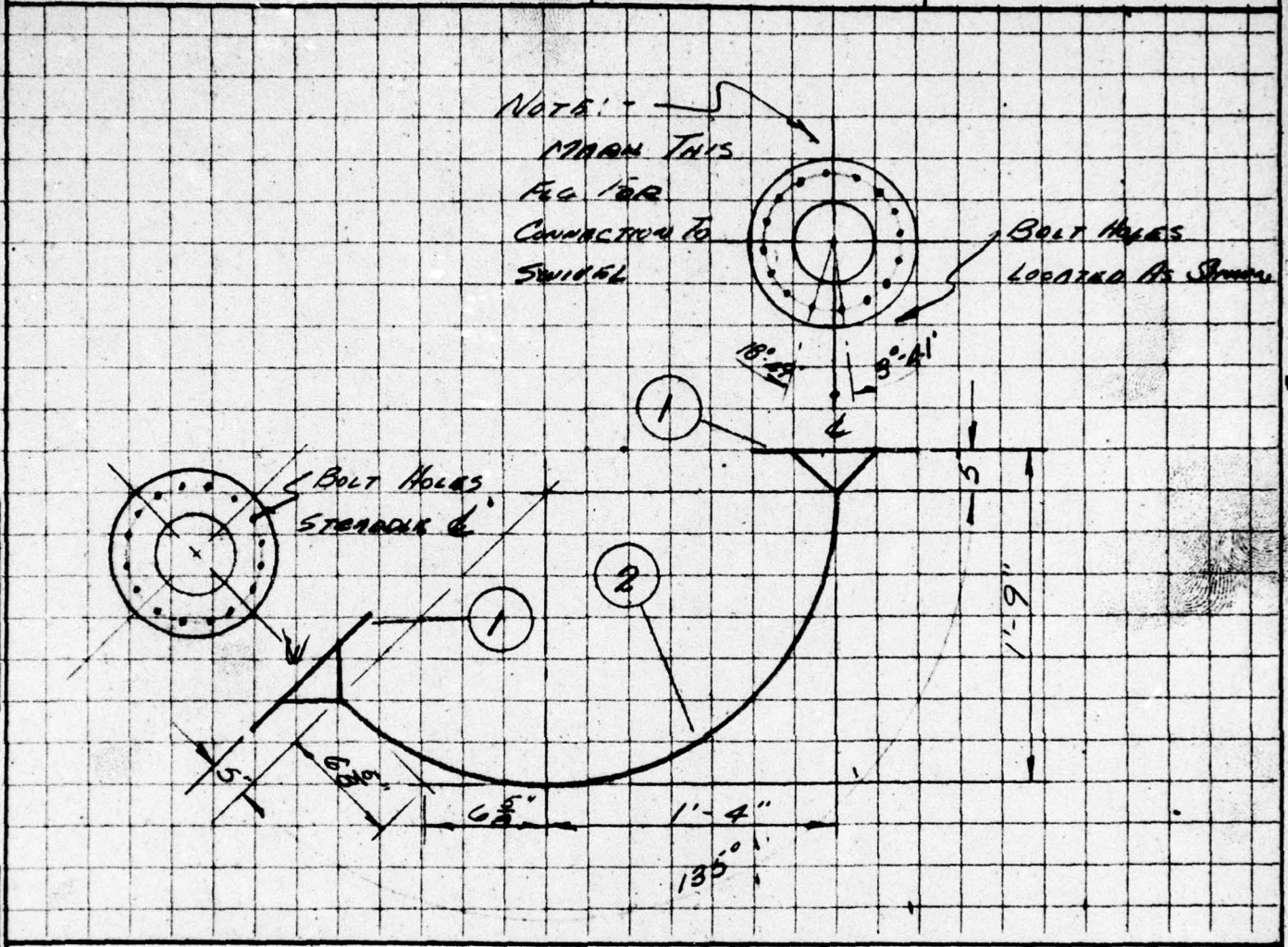
J. RAY McDERMOTT & CO., INC.

COMPANY: U.S. ARMY - ERDL	SHEET NO. 1 of 1
SUBJECT: MONO MOORING SYSTEM - OVERBOARD HOSE CONNECTION	
~~DRAWING~~ NUMBER: J.O. 56017	COMPUTER: wap
CHECKED BY:	DATE: 8/11/65




15°
2-3

CUSTOMER U.S. ARMY - EEDL	CUSTOMER JOB NO.	JOB NO. 56017
ADDRESS	CUSTOMER ORDER NO.	SKETCH NO.



	STRESS RELIEVED ____	TEST PRESSURE

NO. REQ'D	MARK NO.	ISO. REF.	REV.	CHKD.
1	FPS-1R	DWG. REF. USA 2971-SHT 870	REV.	DRWN. DATE: 8-9-65

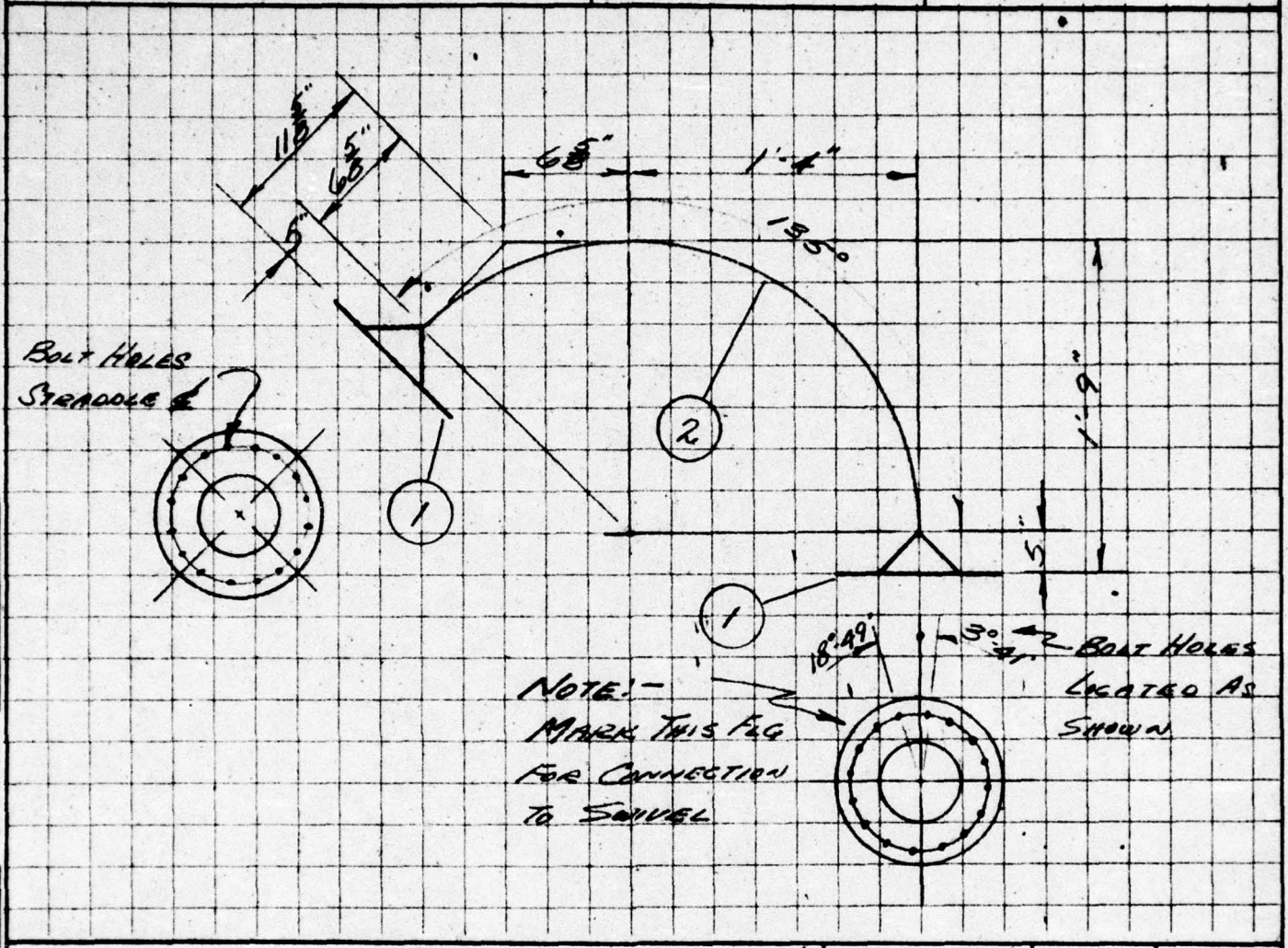
MARK	REQD	SIZE	SCH. OR BORE	W.T. OR CLASS	GRADE	TYPE	DESCRIPTION	UNIT	TOTAL
1	2	16"	STD	150	A181-GR1	FF	WN. FLANGE		
2	1	16	STD	STD	A234-WPB	S.R.	135° REC. BEND		

MATERIAL CHECK: _____ FIT-UP: _____ CHECKED: _____

MCD 12084

McD 12054

CUSTOMER US ARMY ERDL	CUSTOMER JOB NO.	JOB NO. 56017
ADDRESS	CUSTOMER ORDER NO.	SKETCH NO.

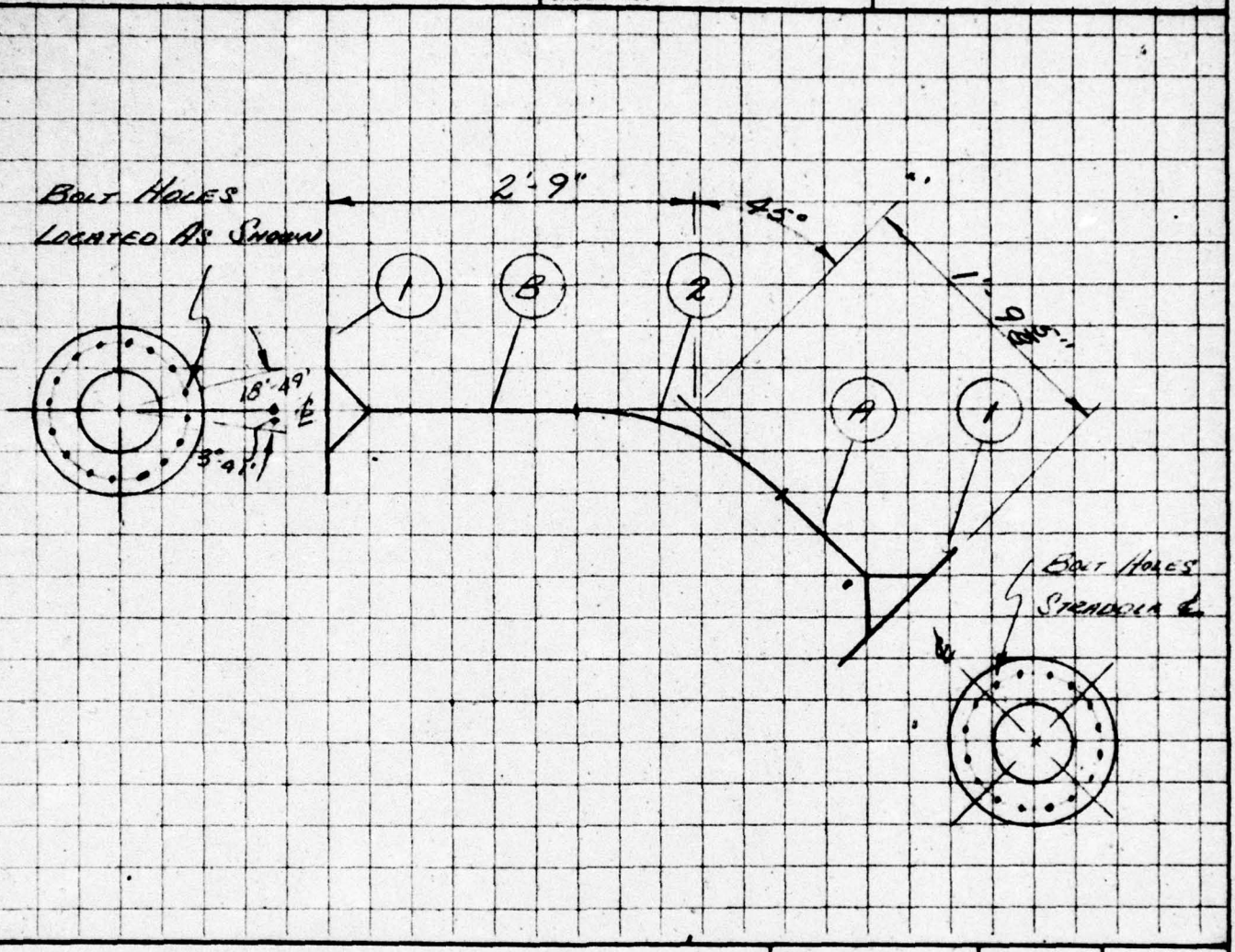


		STRESS RELIEVED ____	TEST PRESSURE
No. REQ'D 1	MARK NO. FPS-1L	ISO. REF.	REV.
		DWG. REF. USA-2971-SAT 890	REV.
			CHKD. ____ DRWN. ____ DATE. 8-11-65

MARK	REQD	SIZE	SCH. OR BORE	W.T. OR CLASS	GRADE	TYPE	DESCRIPTION	UNIT	TOTAL
1	2	16"	STD	150	A181-GR1	F.F.	W.N. FLANGE		
2	1	16"	STD		A234-WPB	S.R.	135° RET BEND		

CHECKED: ____ FIT-UP: ____ MATERIAL CHECK: ____

CUSTOMER U.S. ARMY - ERDL	CUSTOMER JOB NO.	JOB NO. 56017
ADDRESS	CUSTOMER ORDER NO.	SKETCH NO.



STRESS RELIEVED ____	TEST PRESSURE

NO. REQ'D	MARK NO.	ISO. REF.	REV.	CHKD.
1	FPS-2R	DWG. REF. USA 2971 - SHT 570	REV.	DRWN. DATE. 8-9-65

MARK	REQD	SIZE	SCH. OR BORE	W.T. OR CLASS	GRADE	TYPE	DESCRIPTION	UNIT	TOTAL
1	2	16"	STD	150	A181-Gr1	F.F.	WN. FLANGE		
2	1	16"	STD	STD	A234-WPB	L.R.	45° ELL		
A	1	16"	STD		A106-B	SMLS	0'-6 5/8" B.-B.		
B	1	16"	STD	"	"	"	1'-6" B.-B.		

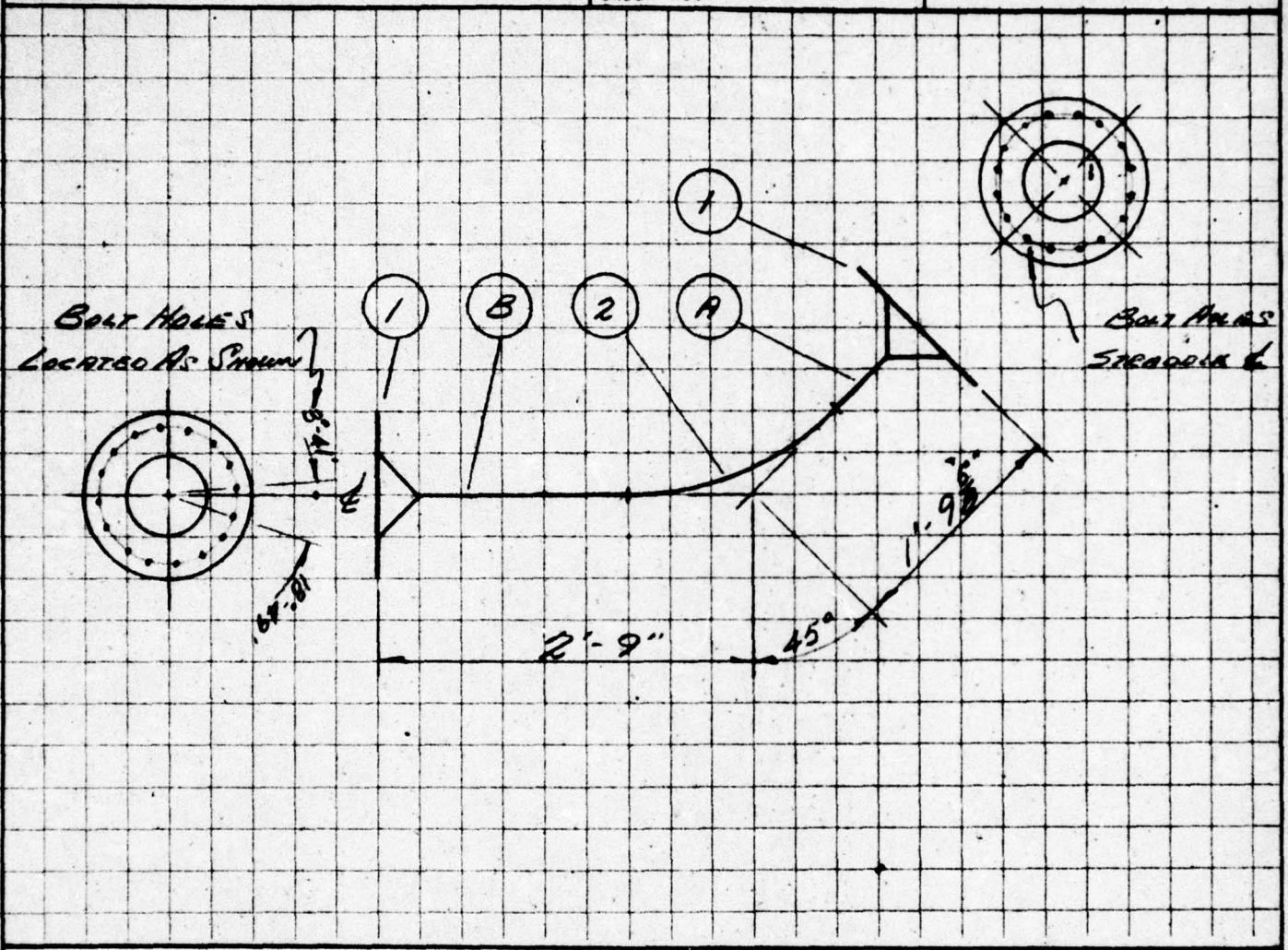
MCD 12084

CHECKED:

FIT-UP:

MATERIAL CHECK:

CUSTOMER U.S. Army - ERDL	CUSTOMER JOB NO.	JOB NO. 56017
ADDRESS	CUSTOMER ORDER NO.	SKETCH NO.



STRESS RELIEVED ____	TEST PRESSURE

No. REQ'D	MARK NO.	ISO. REF.	REV.	CHKD.
1	FSP-2L	DWG. REF. USA 2971 SHT 870	REV.	DRWN. DATE. 8-11-65

MARK	REQD	SIZE	SCH. OR BORE	W.T. OR CLASS	GRADE	TYPE	DESCRIPTION	UNIT	TOTAL
1	2	16"	STD	150	A181-Gr 1	F.F.	N.N. FLANGE		
2	1	16"	STD		A234-WPB	L.R.	45° ELL		
A	1	16"	STD	•	A106-B	SMLS	0'-6 5/8"		
B	1	16"	"		"	"	1'-6"		

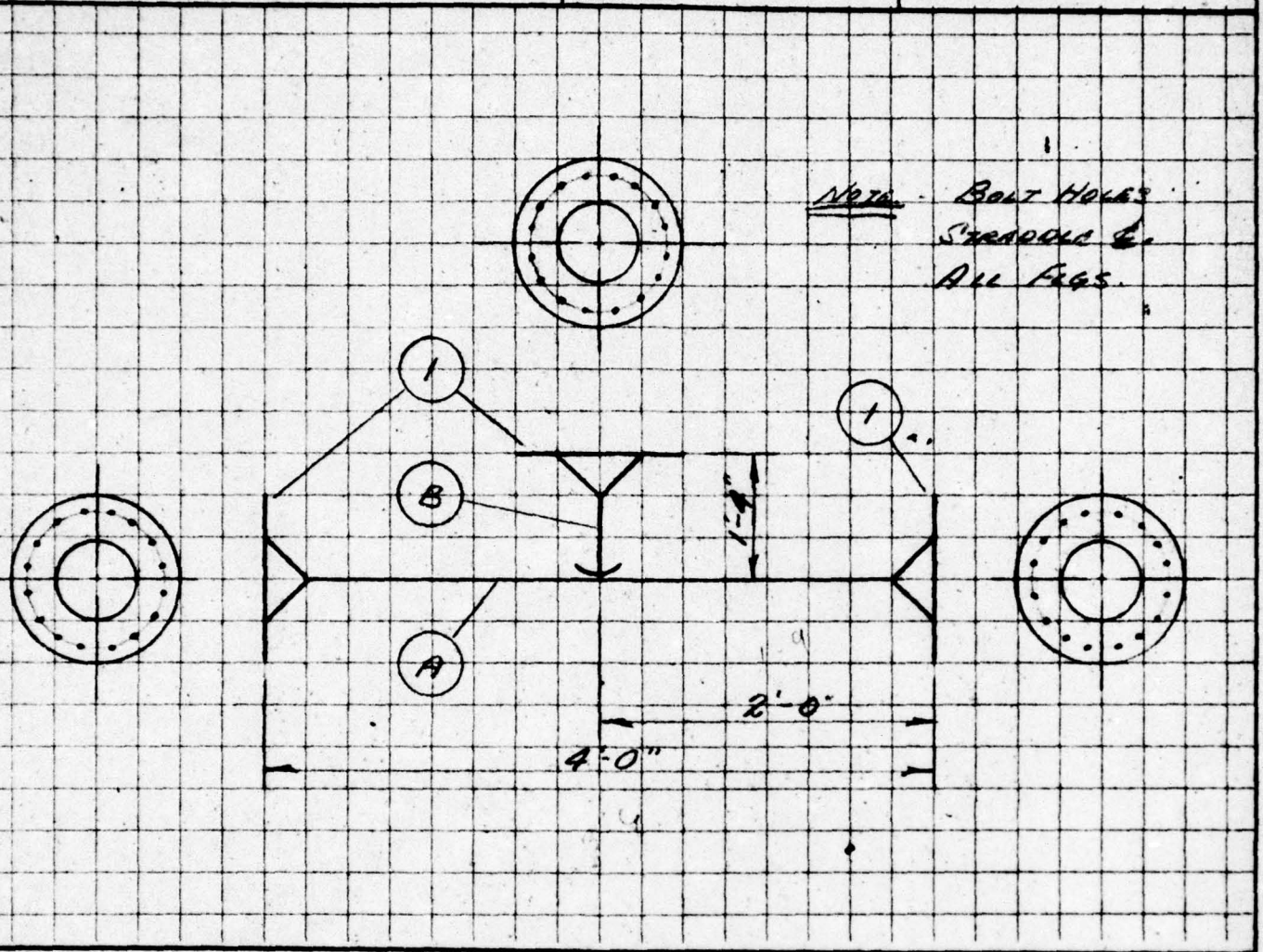
FIT-UP: CHECKED:

MATERIAL CHECK:

MCD 12054

MCD 12084

CUSTOMER U.S Army - ERDL	CUSTOMER JOB NO.	JOB NO. 56017
ADDRESS	CUSTOMER ORDER NO.	SKETCH NO.



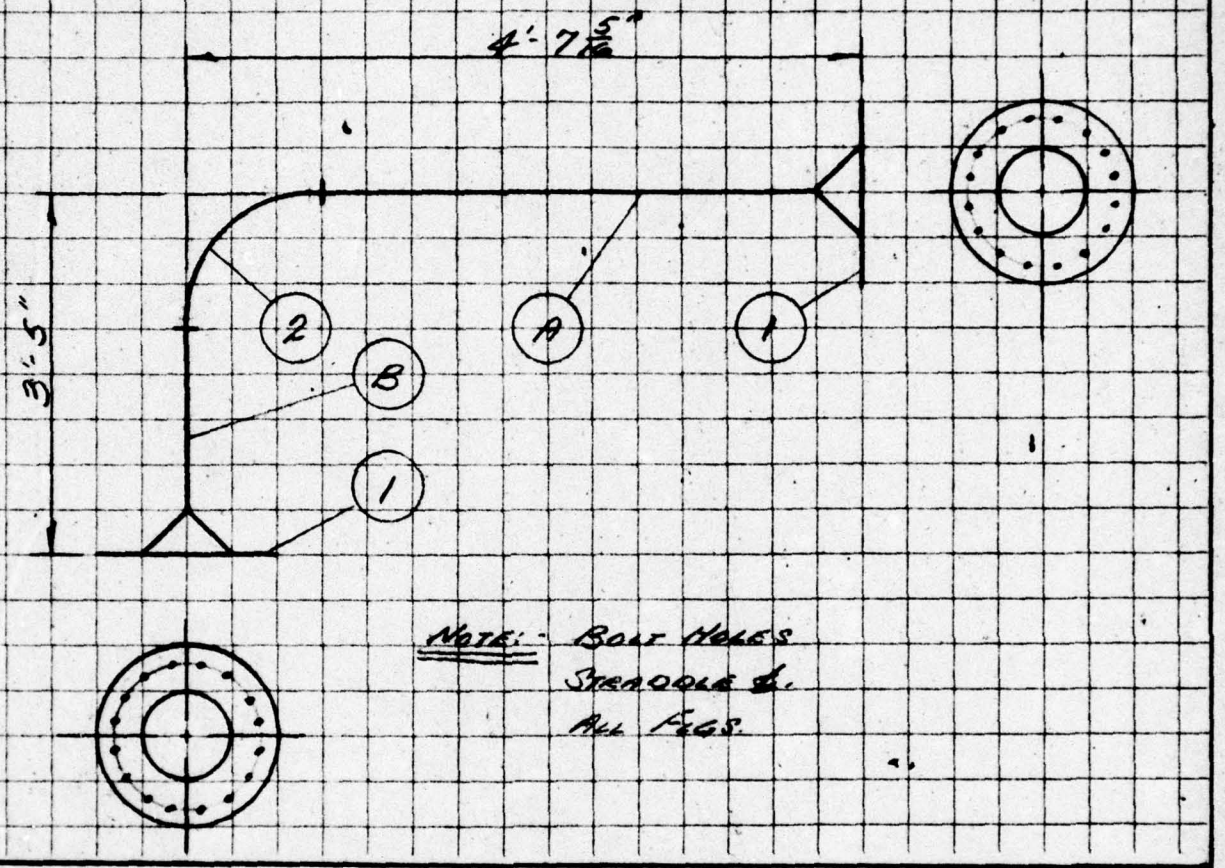
	STRESS RELIEVED?	TEST PRESSURE	
NO. REQ'D 2	MARK NO. FSP - 3	ISO. REF.	REV.
		DWG. REF. USA 2971-Sht 8	REV.
			CHKD.
			DRWN.
			DATE. 8/10/65

MARK	REQD	SIZE	SCH. OR BORE	W.T. OR CLASS	GRADE	TYPE	DESCRIPTION	UNIT	TOTAL
1	3	16	STD	150	A181-GR1	F.F.	W.N. FLANGE		
A	1	16	STD		A106-B	Smls	3'-2" B.B.		
B									

FIT-UP: CHECKED:

MATERIAL CHECK:

CUSTOMER U.S. ARMY - E.R.D.L	CUSTOMER JOB NO.	JOB NO. 56017
ADDRESS	CUSTOMER ORDER NO.	SKETCH NO.



NOTE:- BOLT HOLES STRADDLE ℄. ALL FLGS.

STRESS RELIEVED ____	TEST PRESSURE

No. REQ'D 2	MARK NO. FSP-4	ISO. REF.	REV.	CHKD.
		DWG. REF. WSA 2971 SH1 870	REV.	DRWN. DATE. 8/10/65

MARK	REQD	SIZE	SCH. OR BORE	W.T. OR CLASS	GRADE	TYPE	DESCRIPTION	UNIT	TOTAL
1	2	16"	STD	150	A181-GR1	F.F.	W.N. FLANGE		
2	1	16"	STD		A234-WPB	SMLS	90° L.R. ELL		
A	1	16"	STD		A106-B	SMLS	2'-2 5/16" B.B.		
B	1	16"	STD		"	"	1'-0" B.B.		

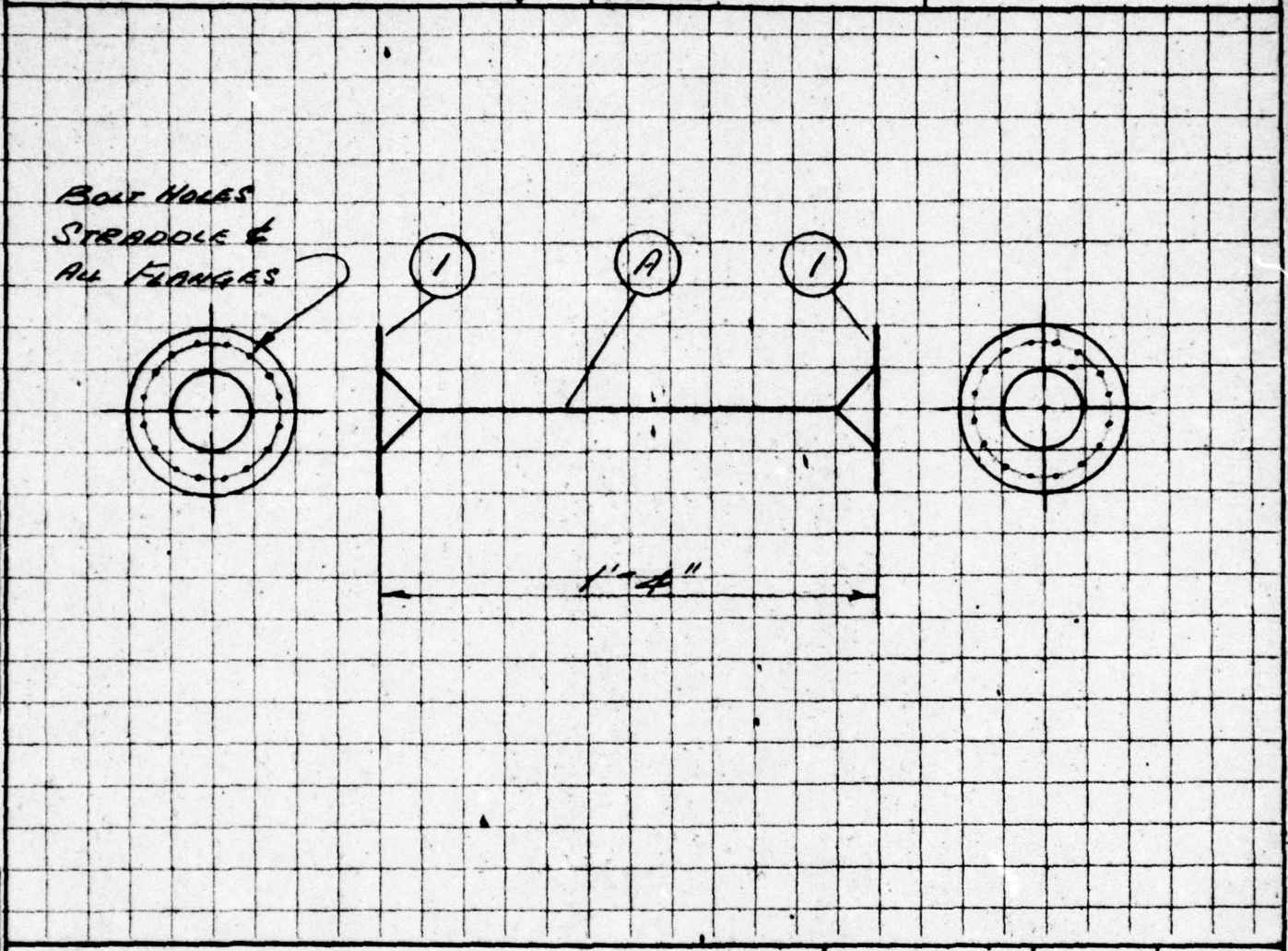
MCD 12084

FIT-UP: _____ CHECKED: _____

MATERIAL CHECK: _____

MCD 12084

CUSTOMER	CUSTOMER JOB NO.	JOB NO.
ADDRESS	CUSTOMER ORDER NO.	SKETCH NO.



FIT-UP: CHECKED:

MATERIAL CHECK:

STRESS RELIEVED ____ TEST PRESSURE ____

No. REQ'D	MARK NO.	ISO. REF.	REV.	CHKD.
2	FSP-5	DWG. REF. USA 29" SHT 870	REV.	DRWN. DATE. 8-11-65

MARK	REQD	SIZE	SCH. OR BORE	W.T. OR CLASS	GRADE	TYPE	DESCRIPTION	UNIT	TOTAL
1	2	16"	STD	150#	A181-Gr.1	F.F.	W.N. FLANGE		
A	1	16"	STD		A106-B	SMLS	0'-6" B.B.		

COMPUTATION SHEET
ENGINEERING DEPARTMENT
McD 5011

J. RAY McDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
U.S. ARMY - ERDL		
ECT	WELL NO.	DATE
MONO MOORING SYSTEM - CARGO PIPING		8/11/65
DRAWING NO.	COMPUTER	
J.O. 56017 OVERBOARD SPOOL PC LGT.	WAP	

LOCATION WATER DEPTH	BUOY HULL FREE BOARD	SPLR #	SPOOL PC LGT.
50'	5.8'	FSP-5	1.22' (1'-2 5/8")
60'	5.5'	FSP-5	.92' (0'-11 1/16")
70'	5.2'	FSP-5	.62' (0'-7 7/16")
80'	4.7'	NONE	.12' (0'-1 7/16")
90'	4.5'	NONE	— .07' (-0'-13/16")
100	5.8'	FSP-5	1.22' (1'-2 5/8")
110'	5.4'	FSP-5	.82' (0'-9 13/16")
120'	5.0'	FSP-5	.42' (0'-5 1/16")
130'	4.7'	NONE	.12' (0'-1 7/16")
140'	4.2'	NONE	— .38' (-0'-4 9/16")
150'	3.9'	NONE	— .68' (-0'-8 3/16")

NOTE: -

SPOOL PC LGT BASED ON HOSE CONNECTING POINT

2'-3" ABOVE WATER LINE.

COMPUTATION SHEET
ENGINEERING DEPARTMENT
McD 5011

J. RAY McDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
U.S. Army - ERDL.		1 of
SUBJECT	WELL NO.	DATE
Mono Mooring System - Piping		7/29/6
DRAWING NO.	COMPUTER	
10.5419 Plot of Branch Conn. Reinf.	WAP Petrie	

200 psi
125°F

PIPE WALL:-

$$\text{Thickness} = t_m = \frac{PD}{2S + 2YP} + C$$

$$t_m = \frac{200 \times 30}{(2 \times 25{,}500) + (2 \times .4 \times 200)} + .06 = \frac{6000}{51000 + 160} + .06 = .178$$

INTERSECTION REINFORCEMENT:-

$$\text{Reinf. Area Reqd} = (A_R = t_h d_1)(2 - \sin\beta)$$

$$A_R = (.178 \times 17)(2 - \sin 32°30') = 4.4 \text{ sq in}$$

Reinforcement

$$A_1 = (T_h - t_h)(d) = (.500 - .178)17 = 5.57$$

$$A_2 = 2(L_4)(T_b - t_b) = 2(1.25)(.500 - .178) = .66$$

$A_1 + A_2 = 5.57 + .66 = 6.23$ which is greater than A_R therefore no reinforcement required

COMPUTATION SHEET
ENGINEERING DEPARTMENT
MCD 5011

J. RAY MCDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
U.S. ARMY ERDL		1 of
SUBJECT	WELL NO.	DATE
NOMO MOORING SYSTEM - PIPING -		7/27/65
DRAWING NO.	COMPUTER	
J.O. 56017 BRANCH COMP. REINFORCEMENT	WAP	

REINFORCEMENT AREA REQUIRED

$$A_R = (t_h d_1)(2 - \sin\beta)$$

$$A_R = (.375 \times 17)(2 - \sin 32°50') = 6.37(1.45) = \underline{9.25 \text{ sq in}}$$

REINFORCEMENT

IN HEADER = $A_1 = T_h - t_h(d) = (.500 - .375)(17) = 2.1$ sq in

IN BRANCH = $A_2 = T_b - t_b(2)(L_4) = (.500 - .375(2)(1.25) = .31$ sq in

IN REINF. COLLAR = $A_3 = 2(te)(w) = 2(.500)(6.5) = 6.5$ sq in

$A_1 + A_2 + A_3 = 2.1 + .31 + 6.5 = \underline{8.91 \text{ sq in} + \text{WELDING}}$
$= > 9.25"$

REINFORCEMENT COLLAR =

6.5" WIDE = W
.500" THICK = te

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

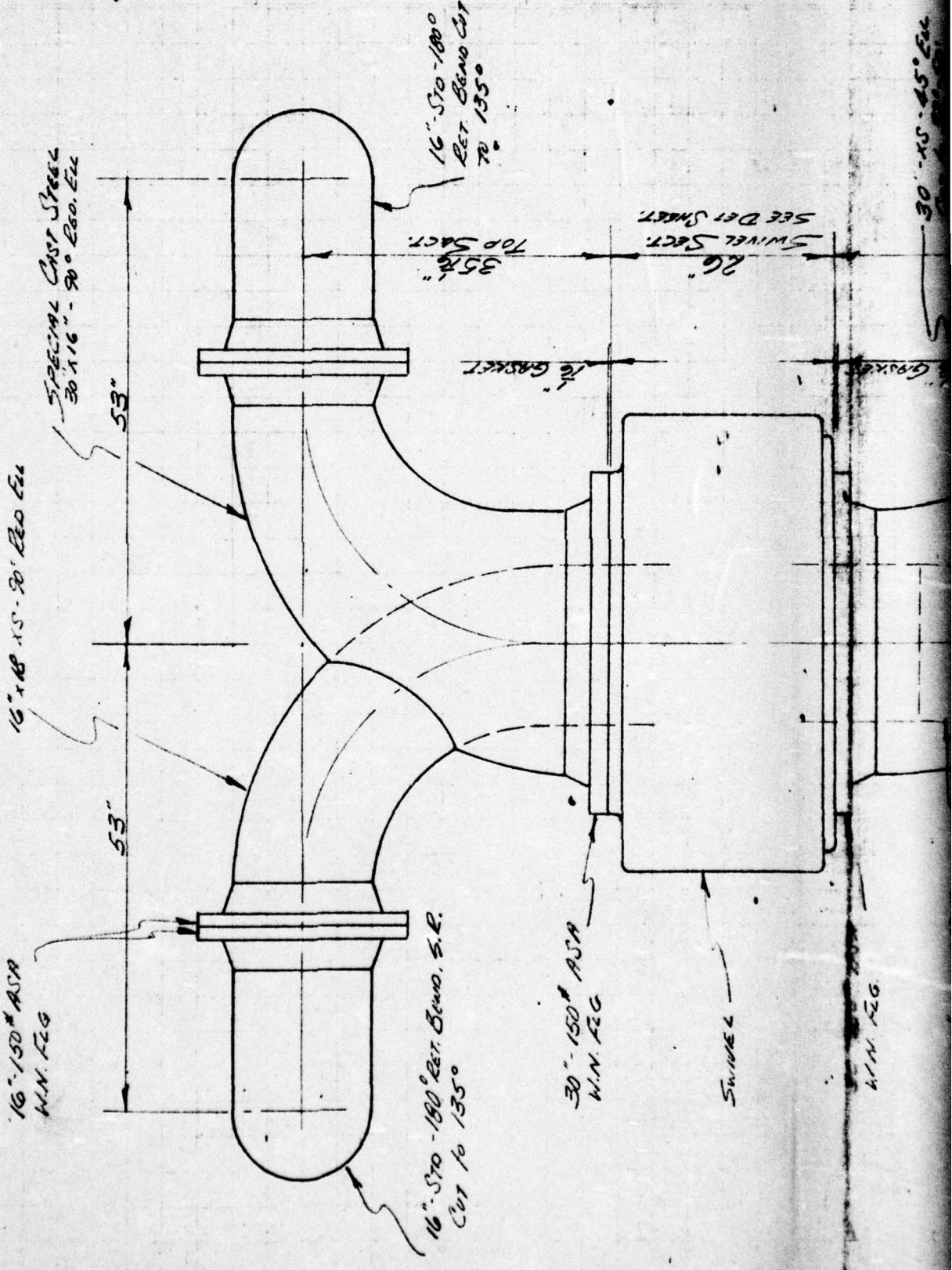
J. RAY McDERMOTT & CO., INC.

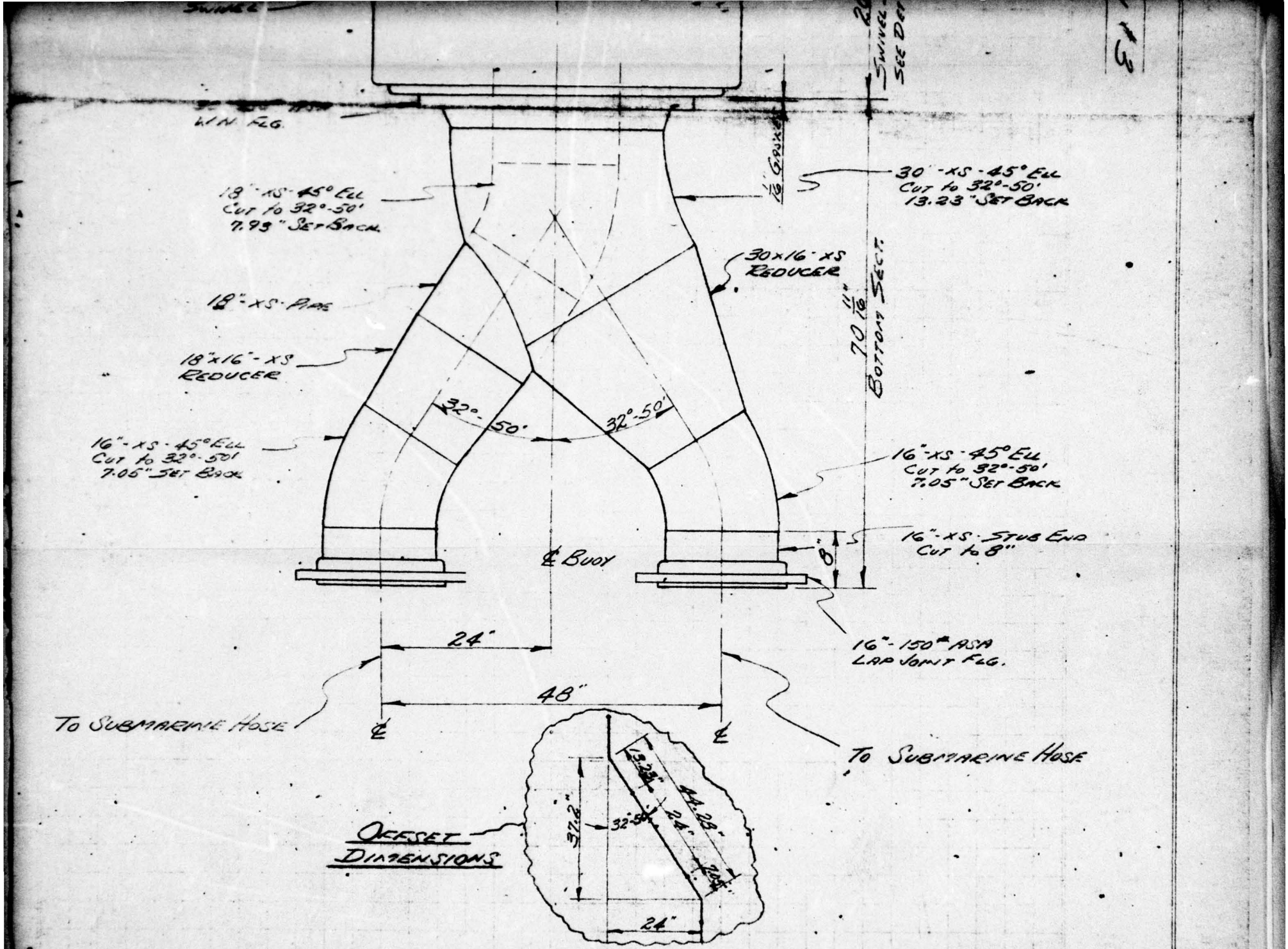
COMPANY	SHEET NO
U. S. ARMY - ERDL	1 of

SUBJECT: MONO MOORING SYSTEM - SWIVEL, DESIGN #3

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
J.O. 56017	WAP		4-21-65

ELEVATION



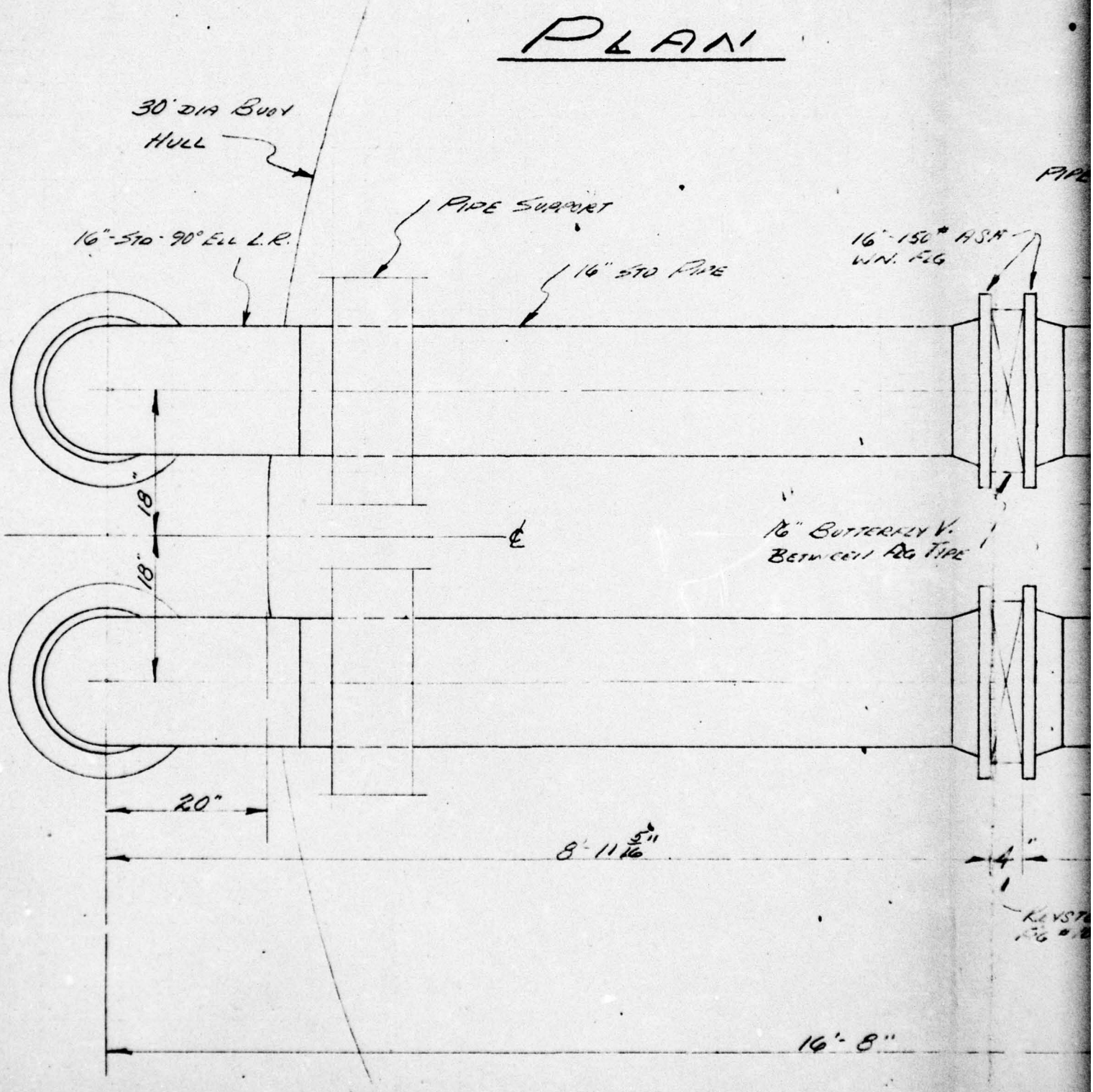

WN FLG.
18"-XS-45° ELL
CUT to 32°-50'
7.93" SET BACK
30"-XS-45° ELL
CUT to 32°-50'
13.23" SET BACK
30x16"-XS
REDUCER
18"-XS-PIPE
18"x16"-XS
REDUCER
70 11/16" BOTTOM SECT.
32°-50'
32°-50'
16"-XS-45° ELL
CUT to 32°-50'
7.05" SET BACK
16"-XS-45° ELL
CUT to 32°-50'
7.05" SET BACK
16"-XS-STUB END
CUT to 8"
8"
℄ BUOY
24"
48"
16"-150# ASA
LAP JOINT FLG.
TO SUBMARINE HOSE
TO SUBMARINE HOSE
OFFSET
DIMENSIONS
37.2"
32-50'
44.23"
24"
24"
24"

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

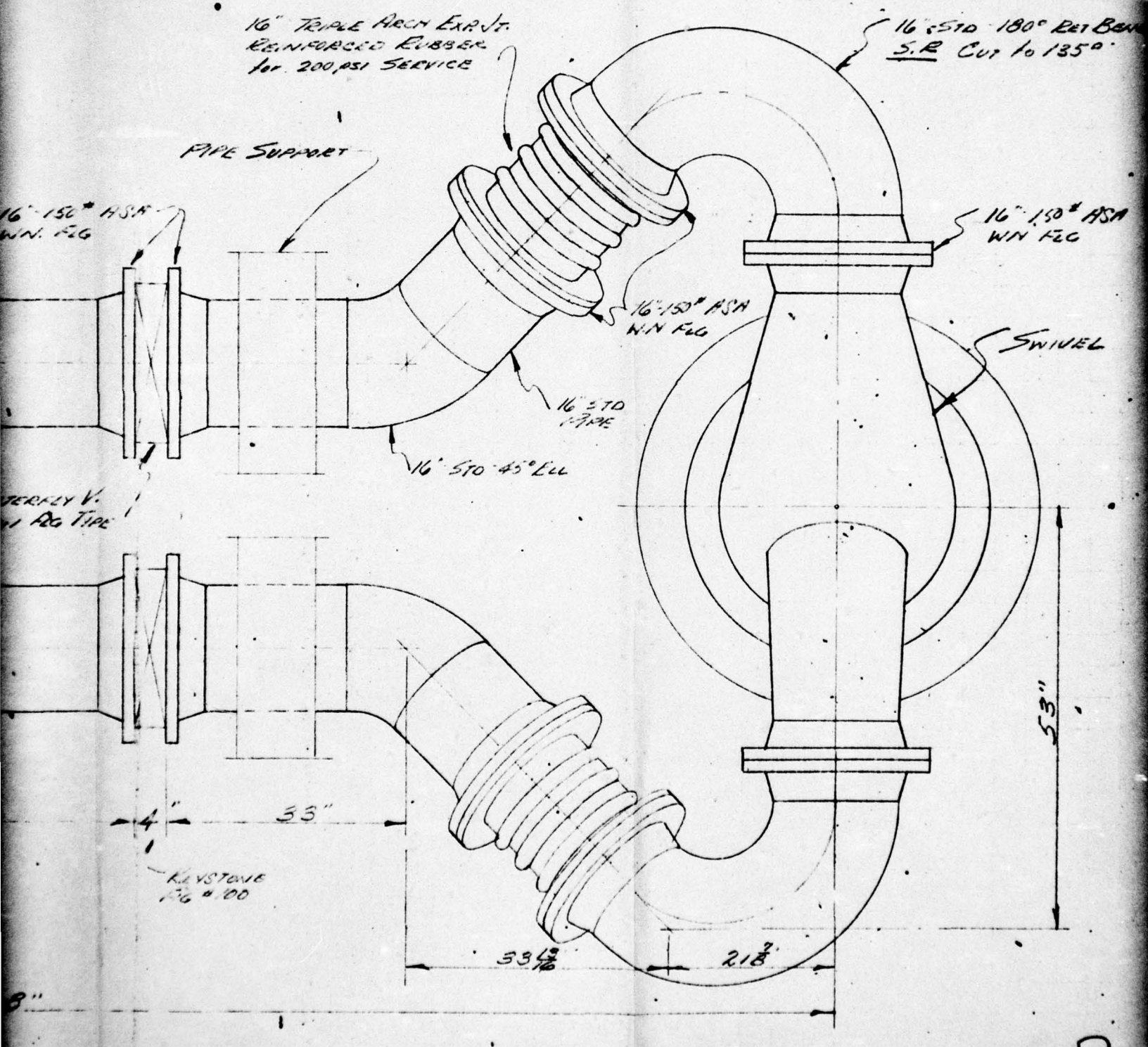
J. RAY McDERMOTT & CO., INC.

COMPANY		SHEET NO
U.S. ARMY - ERDL		2 of
SUBJECT		
MONO MOORING SYSTEM - DECK PIPING ARRGT DESIG		
DRAWING ~~NUMBER~~	COMPUTER	CHECKED BY	DATE
J.O. 56017	WRP		4-22-65

PLAN



AERGT DESIGN #3

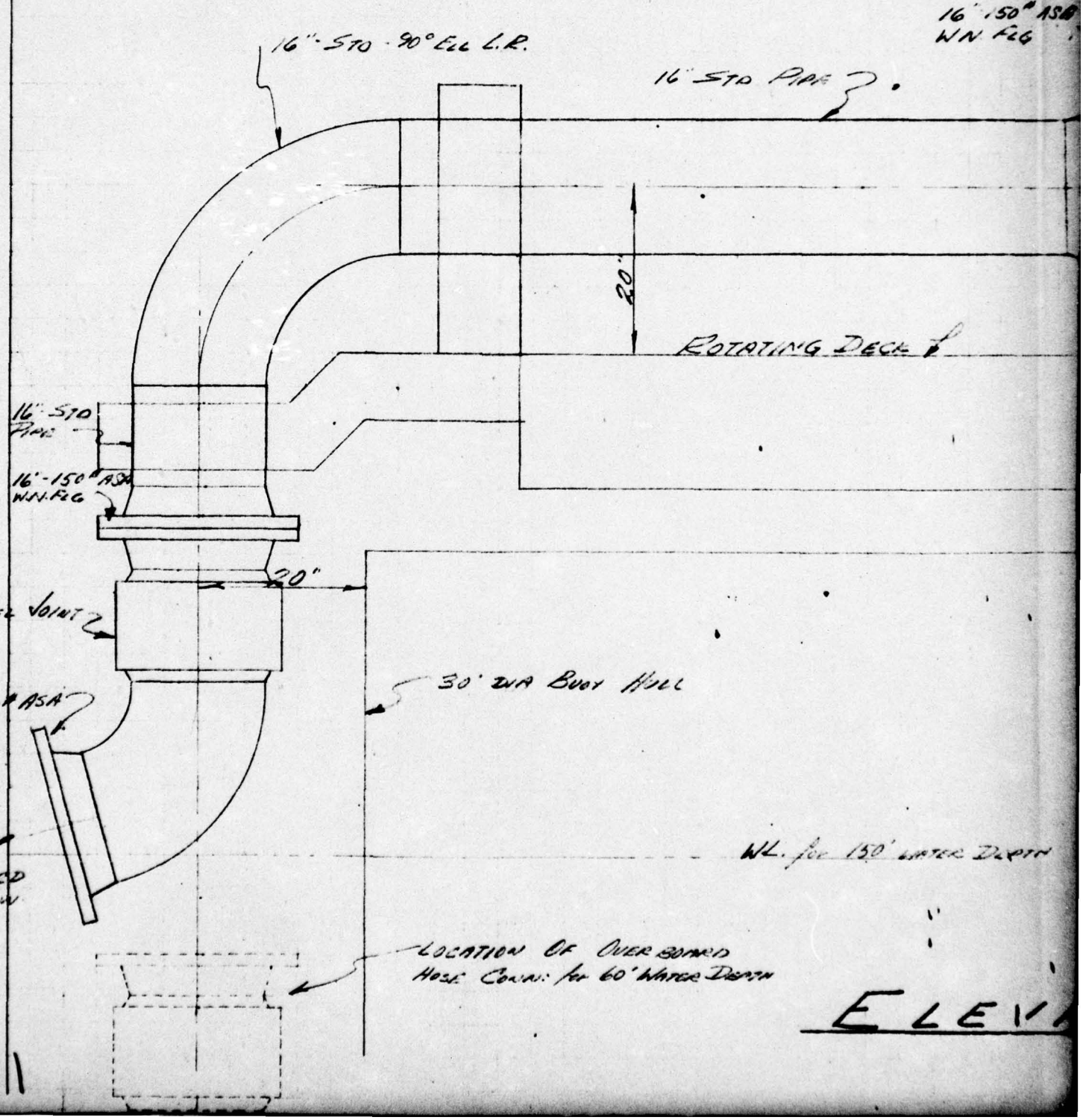


2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

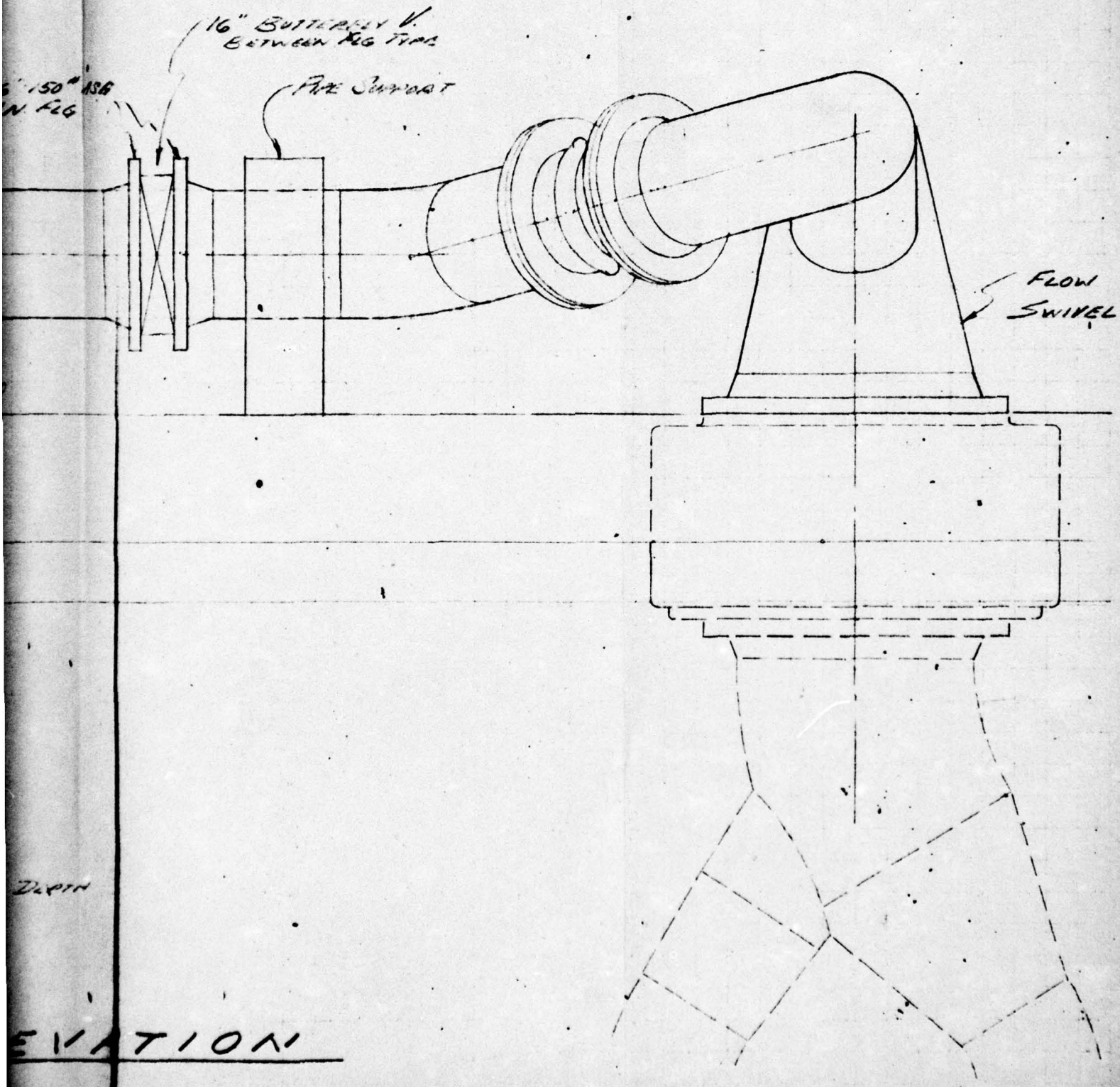
J. RAY McDERMOTT & CO., INC.

COMPANY			SHEET NO
U.S. ARMY - ERDL			3 of 4
SUBJECT: MONO MOORING SYSTEM - DECK PIPING ARRGT.			
DRAWING ~~NUMBER~~ J.O. 56017	COMPUTER WAP	CHECKED BY	DATE 4/22/65



ELEV

ERGT. DESIGN #3



DEPTH

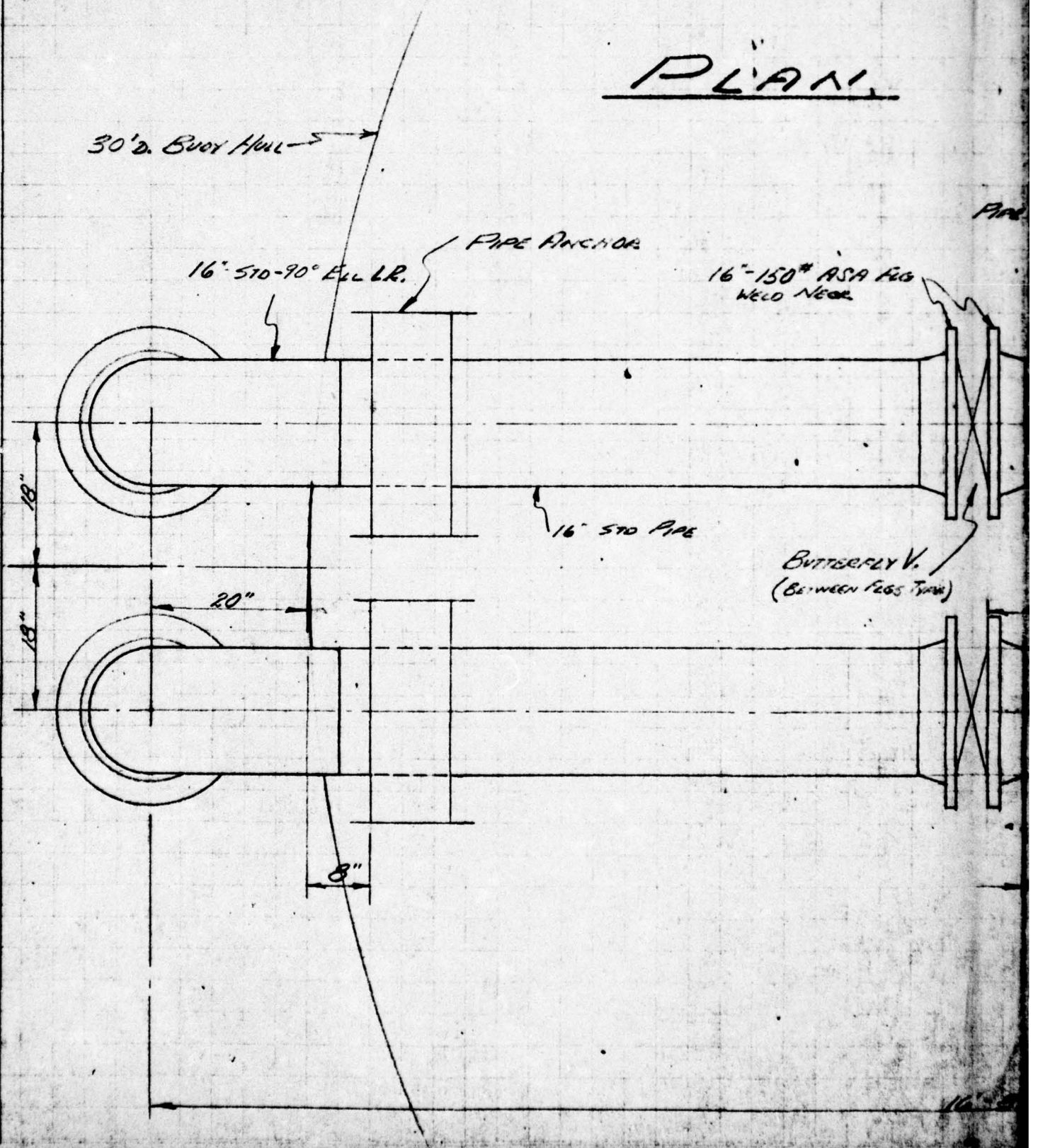
EVATION

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

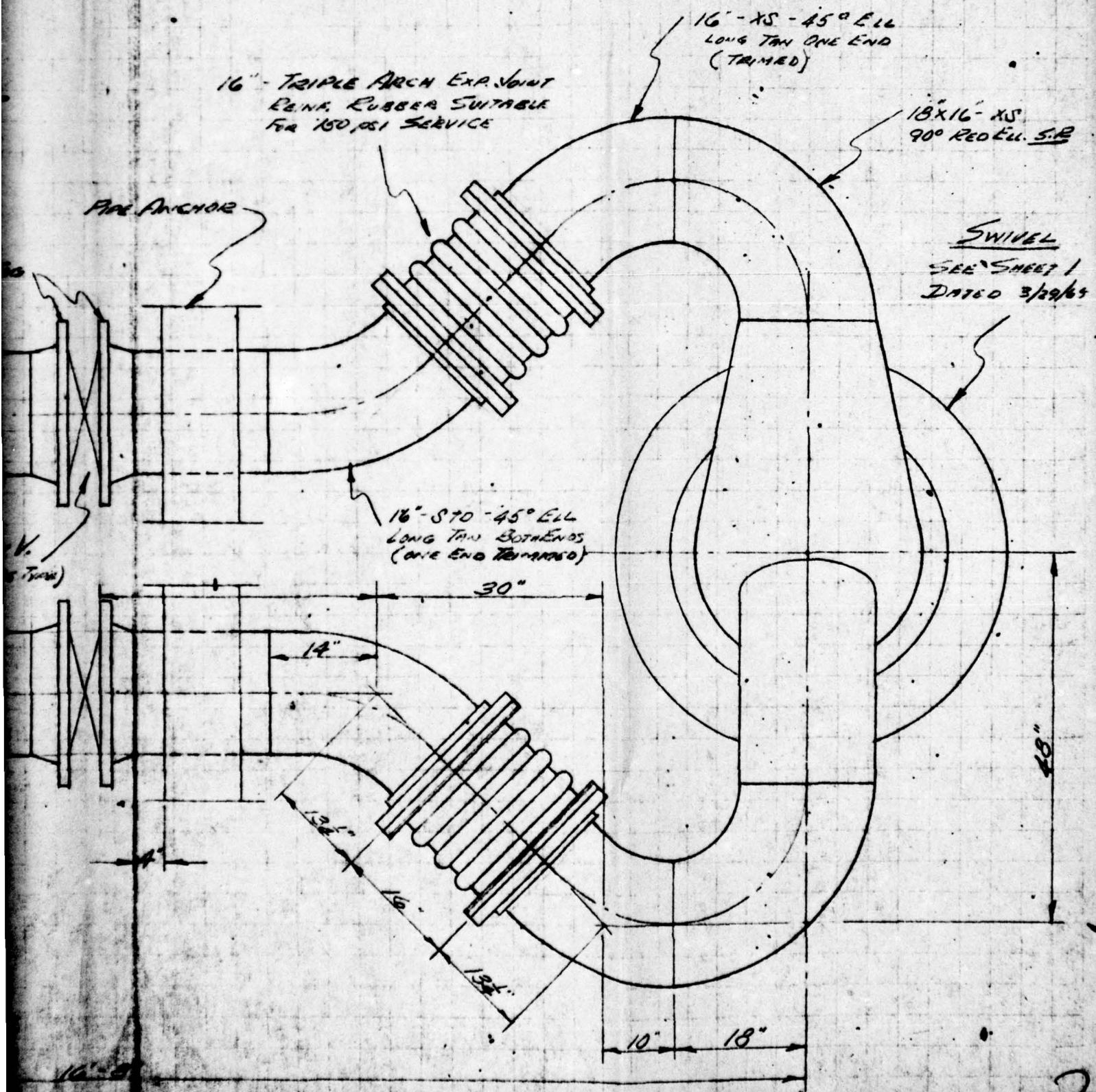
COMPANY		SHEET NO
U.S. ARMY - ERDL		2 of
SUBJECT		
MONO MOORING SYSTEM - FLOW SWIVEL PIPING		
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
J.O. 56017	WAP		3-29-65

PLAN



PING DESIGN #1

65



2

COMPUTATION SHEET

J. RAY McDERMOTT & CO., INC.

COMPANY: U.S. ARMY - ERDL

SHEET NO: 1 of 1

SUB-JECT: MOORING SYSTEM - SINGLE Design #1

JOB NUMBER: JC 5604

COMPUTED BY: LBP

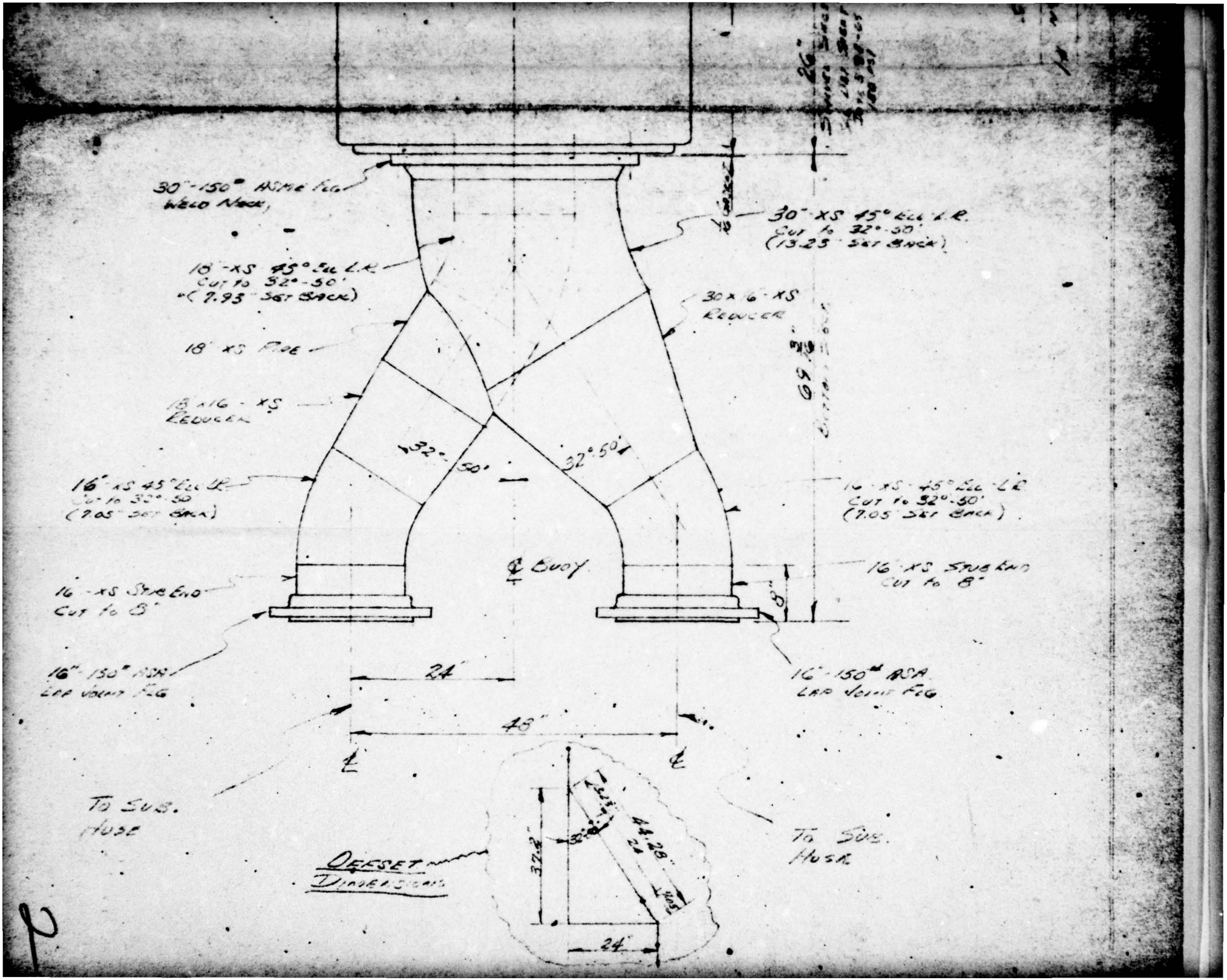
CHECKED BY:

DATE: 3-29-65

NOTE

FOR PLAN VIEW
SEE SHEET 2
OF SAME DATE

ELEVATION


30"-150# ASME FLG
WELD NECK,
30"-XS 45° ELL L.R.
CUT TO 32°-50'
(13.23" SET BACK)
18"-XS 45° ELL L.R.
CUT TO 32°-50'
(7.93" SET BACK)
30 x 16-XS
REDUCER
18" XS PIPE
18 x 16 - XS
REDUCER
32°-50'
32°-50'
16"-XS 45° ELL L.R.
CUT TO 32°-50
(7.05" SET BACK)
16"-XS 45° ELL L.R.
CUT TO 32°-50'
(7.05" SET BACK)
℄ BUOY
16"-XS STUB END
CUT TO 8"
16"-XS STUB END
CUT TO 8"
8"
16"-150# ASA
LAP JOINT FLG
16"-150# ASA
LAP JOINT FLG
24"
48"
℄
℄
TO SUB.
HOSE
TO SUB.
HOSE
OFFSET
DIMENSIONS
37.2"
32°
44.28"
24
24"
26"
69 3/16"

2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

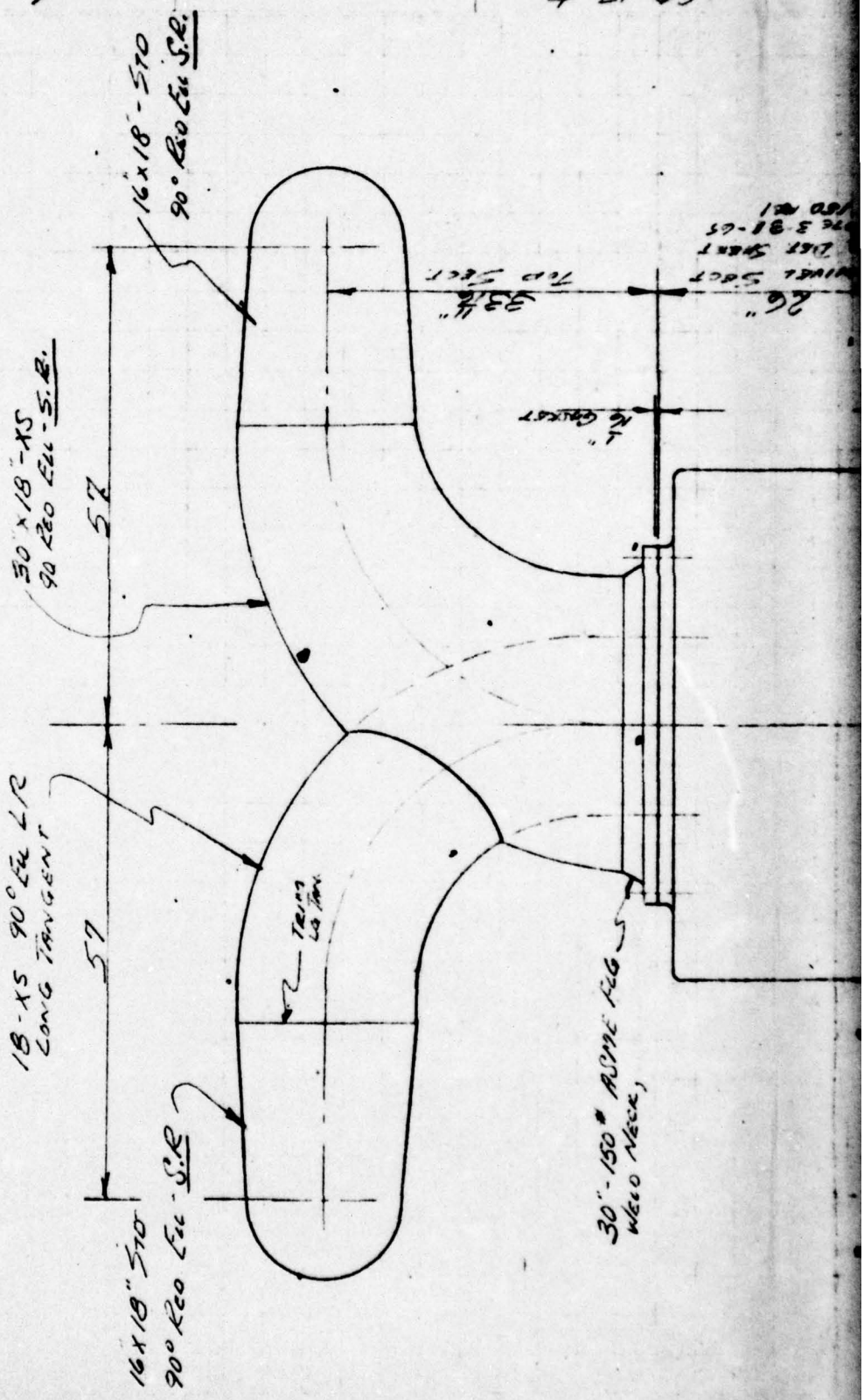
J. RAY McDERMOTT & CO., INC.

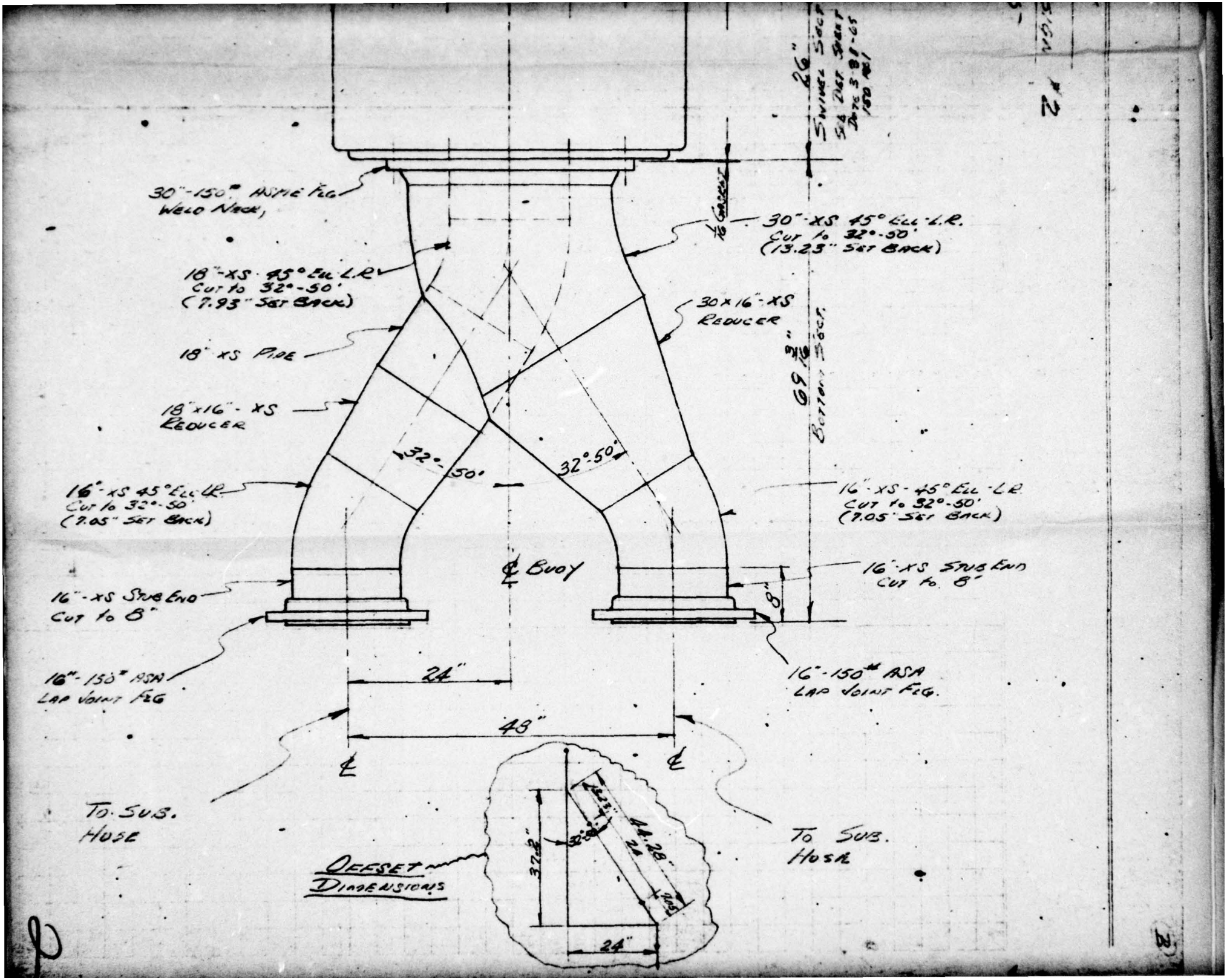
COMPANY		SHEET NO
U.S ARMY - ERDL		1 of
SUBJECT		
MOORING SYSTEM - SWIVEL DESIGN #2		
JOB NUMBER	COMPUTER	CHECKED BY	DATE
JO. 56017	WP		4-21-65

NOTE

FOR PLAN VIEW
SEE SHEET 2
OF SAME DATE

ELEVATION





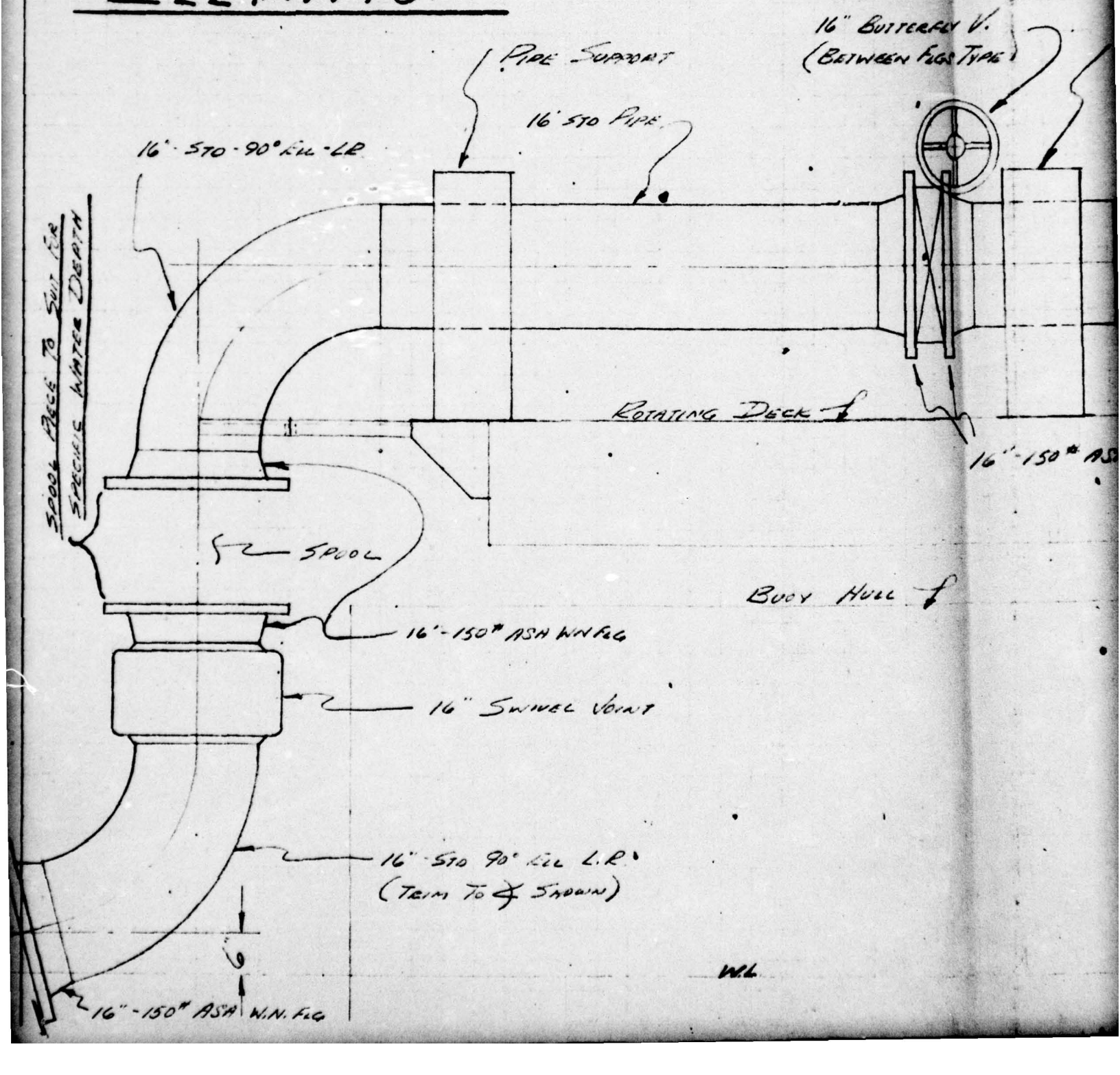
26"
Swivel Sect
Sch Dist Sheet
Date 3-31-65
150 PSI
30"-150# ASME Flg
Weld Neck,
1/16 Gasket
30"-XS 45° Ell-L.R.
Cut to 32°-50'
(13.23" Set Back)
18"-XS 45° Ell L.R.
Cut to 32°-50'
(7.93" Set Back)
30 x 16"-XS
Reducer
18" XS Pipe
69 3/16"
Bottom Sect.
18" x 16"-XS
Reducer
32°-50'
32°-50'
16"-XS 45° Ell L.R.
Cut to 32°-50'
(7.05" Set Back)
16"-XS-45° Ell-L.R.
Cut to 32°-50'
(7.05" Set Back)
℄ Buoy
16"-XS Stub End
Cut to 8"
16"-XS Stub End
Cut to 8"
8"
16"-150# ASA
Lap Joint Flg
16"-150# ASA
Lap Joint Flg.
24"
48"
℄
℄
To Sub.
Hose
To Sub.
Hose
Offset
Dimensions
37.2"
32°
44.28"
24
24"

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

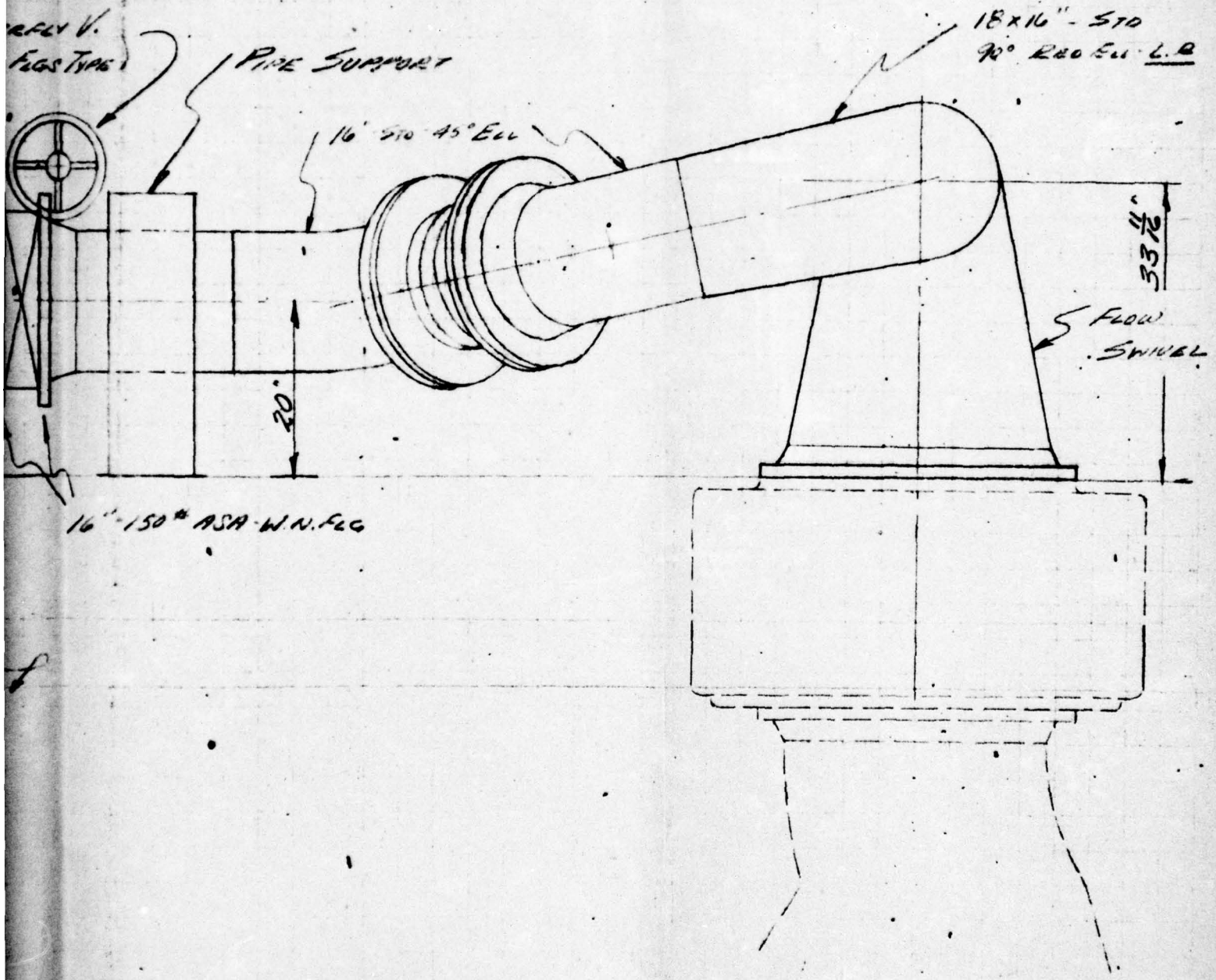
COMPANY			SHEET NO
U.S ARMY - ERDL			3 of
SUBJECT			
MONO MOORING SYSTEM - FLOW SWIVEL PIPING D			
DRAWING	COMPUTER	CHECKED BY	DATE
J.O. 56017	WAP		4/20/65

ELEVATION



WL

PIPING DESIGN #2



2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY		SHEET NO
U.S. ARMY - ERDL		21
SUBJECT		
MONO MOORING SYSTEM - FLOW SWIVEL PIPING DESI		
DRAWING ~~NUMBER~~	COMPUTER	CHECKED BY
J.O. 56017	WAP	DATE 4-20-65

16" TRIPLE ARCH EAR
REINFORCED RUBBER
FOR 20#BI SERVICE

PLAN

(N.T.S.)

30' DIA BUOY HULL

PIPE SUPPORT

16" STD 90° ELL - L.R.

16" STD PIPE

16" - 150# ASA W.N. FLG

PIPE SUPPORT

16" BUTTERFLY V (BETWEEN FLGS TYPE)

18"

18"

20"

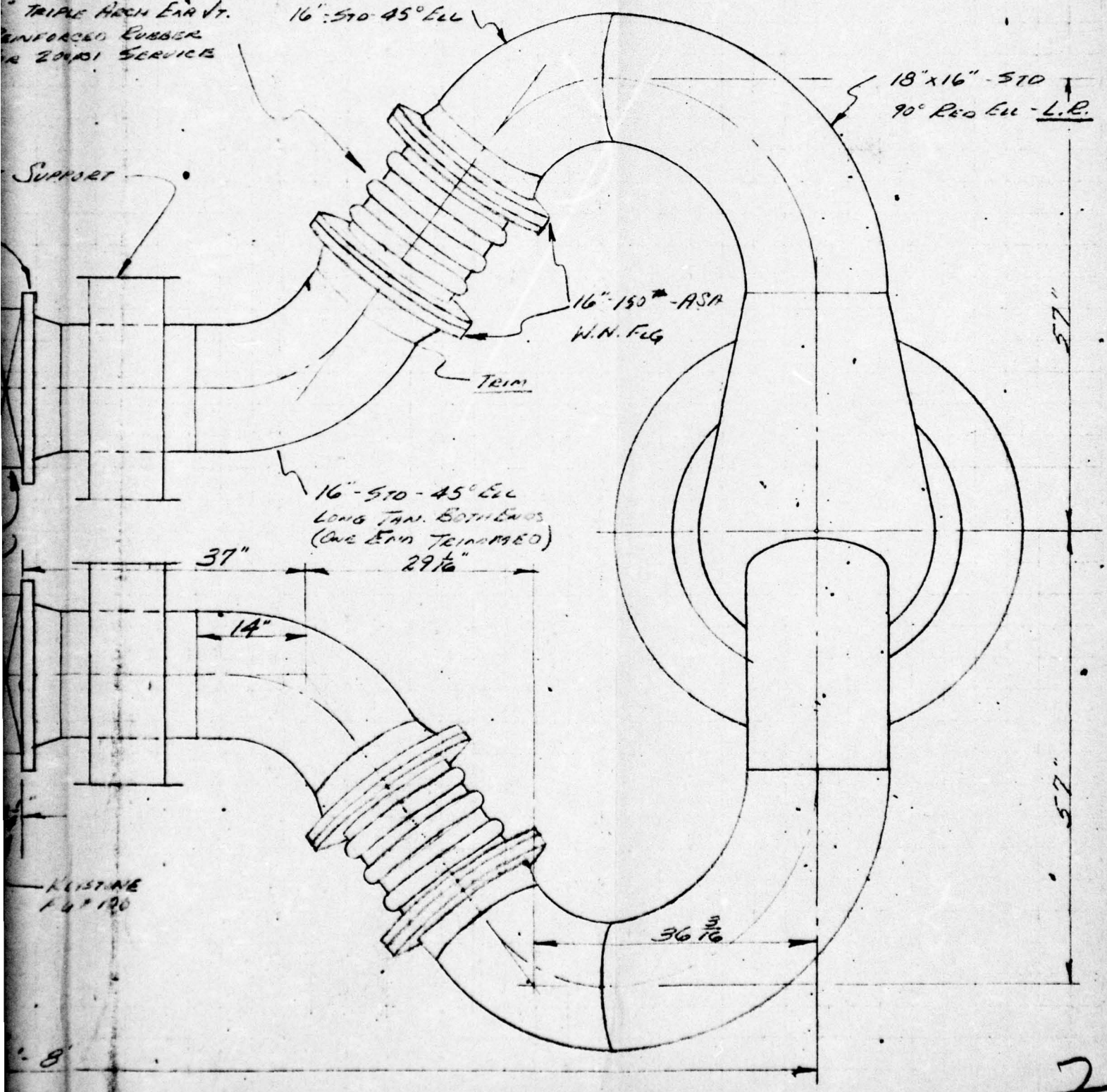
7'-9½"

4¼"

KEYSTONE FLG #120

16'-8"

PIPING DESIGN #2



2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

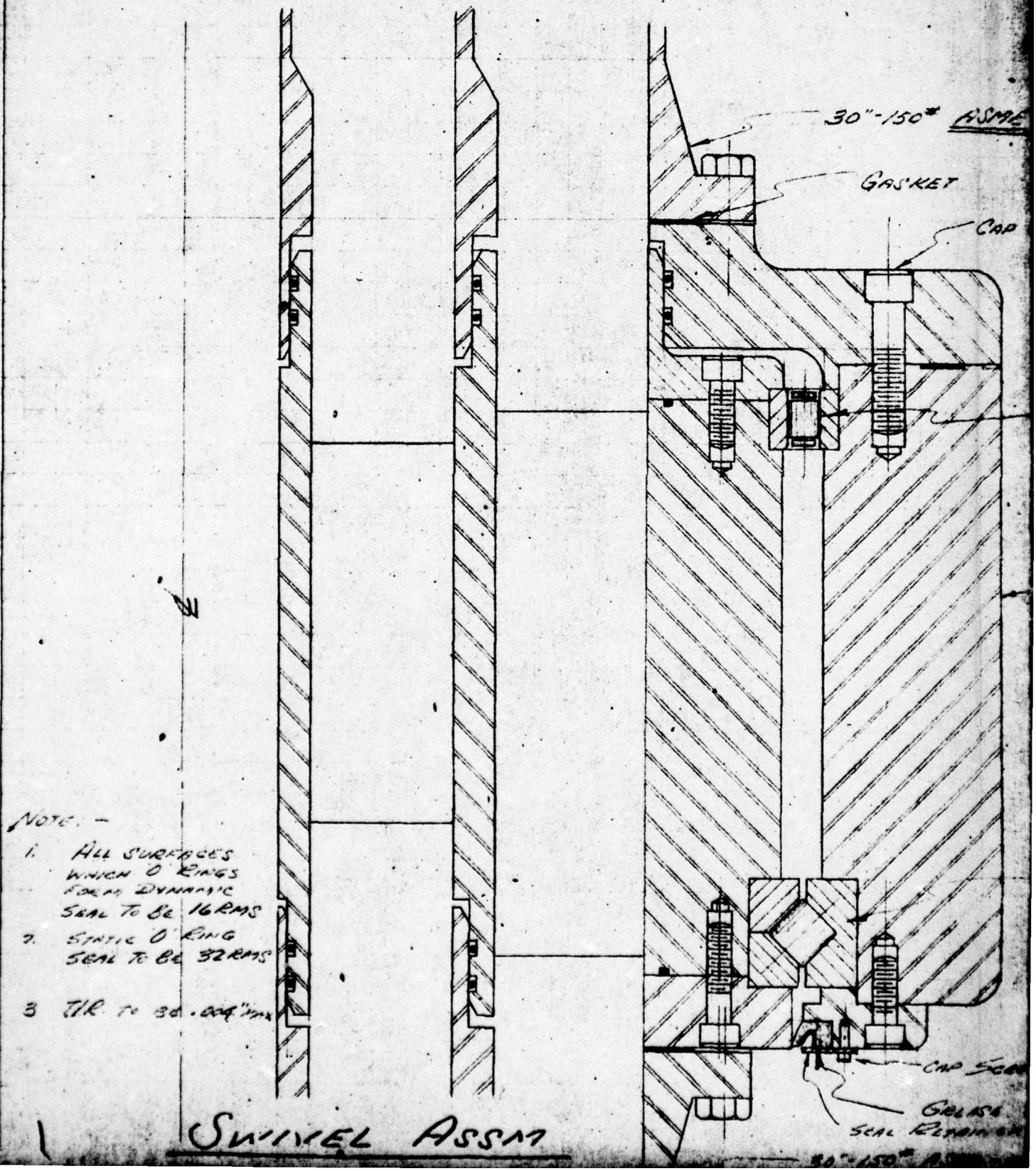
J. RAY McDERMOTT & Co., INC.

COMPANY	SHEET NO
U.S ARMY - EROL	

SUBJECT

MONO MOORING SYSTEM - SWIVEL DESIGN for 15

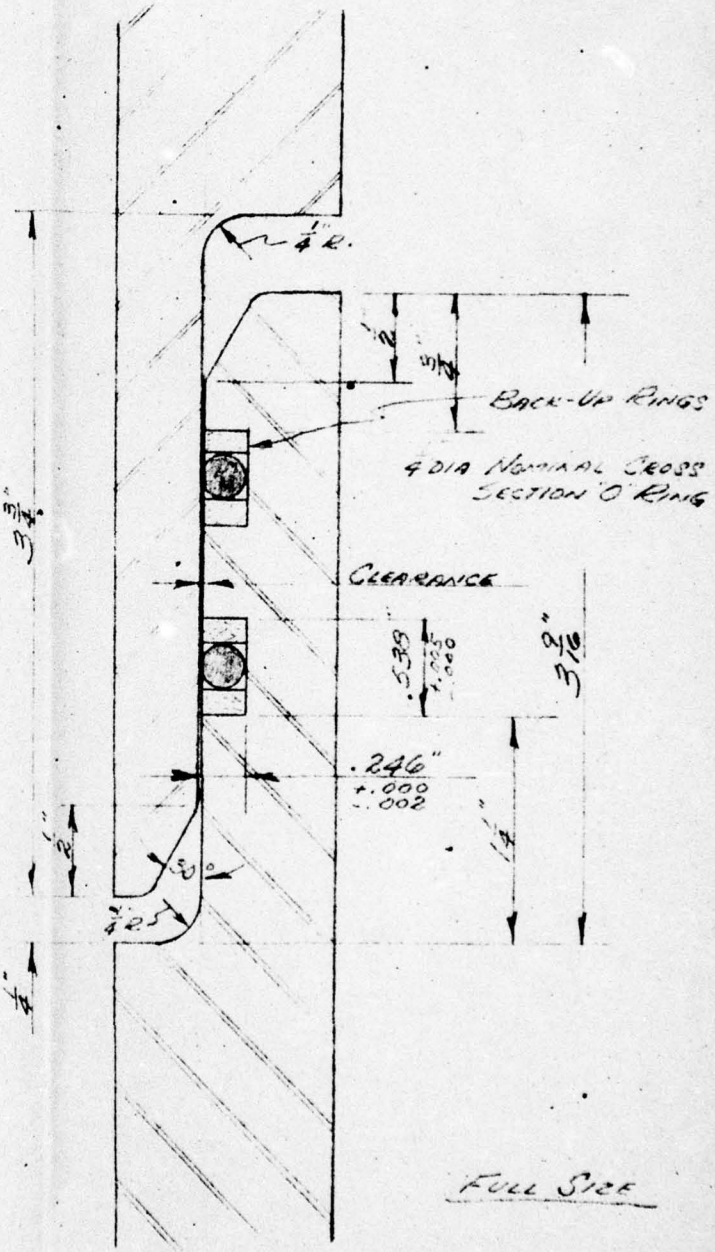
NUMBER	COMPUTER	CHECKED BY	DATE
J.O. 56017	WAP		3-25-65



NOTE: -

1. ALL SURFACES WHICH O RINGS FORM DYNAMIC SEAL TO BE 16 RMS
2. STATIC O RING SEAL TO BE 32 RMS
3. TIR TO BE .004" MAX

SWIVEL ASSM



FULL SIZE

TYPICAL SEAL ASSY.

RADIAL ROLLER BRG.

HOUSING

'X' TYPE ROLLER BRG

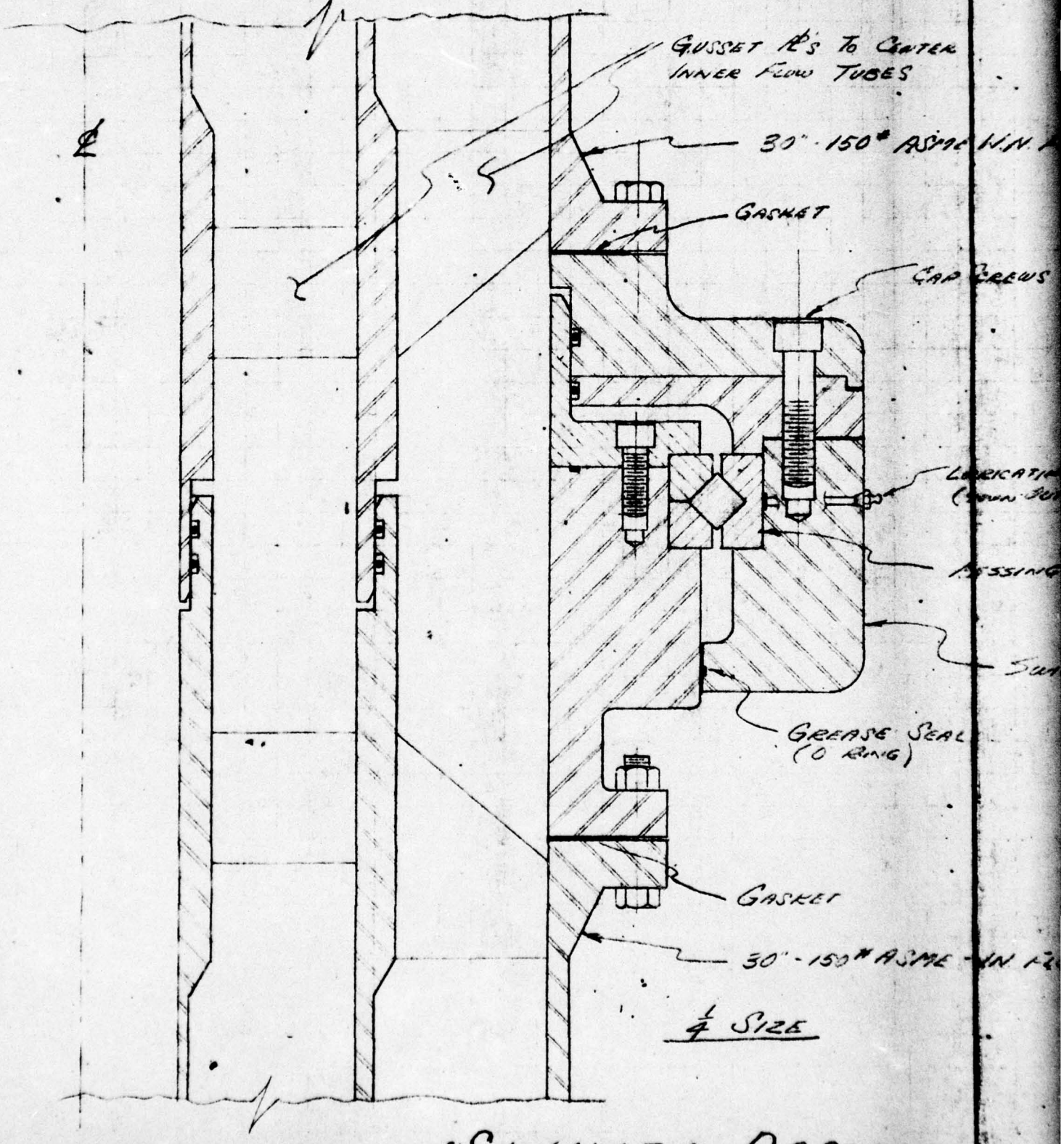
2

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & Co., INC.

MCD 14003

COMPANY		SHEET NO
U.S ARMY - E.R.D.L		1 of
PROJECT		
MONO MOORING SYSTEM - SWIVEL DESIGN		
NUMBER	COMPUTER	CHECKED BY	DATE
Jo 56017	WAF		2-25-65



SWIVEL ASSY

ESIGN

5

To Center
TUBES

50# ASME N.N. FLG

CAP SCREWS

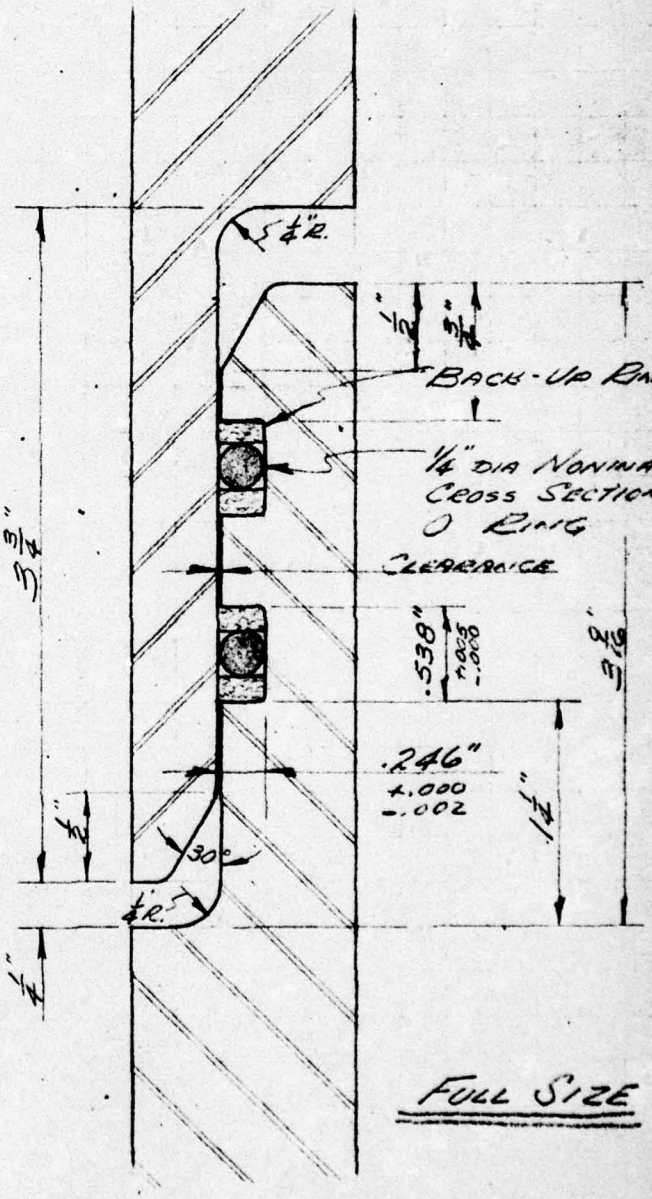
LUBRICATING FITTING
(Drawn But Of Phase For Clarity)

PASSINGER X BEARING

SWIVEL HOUSING

ASE SEAL
RING)

0# ASME - NN FLG



FULL SIZE

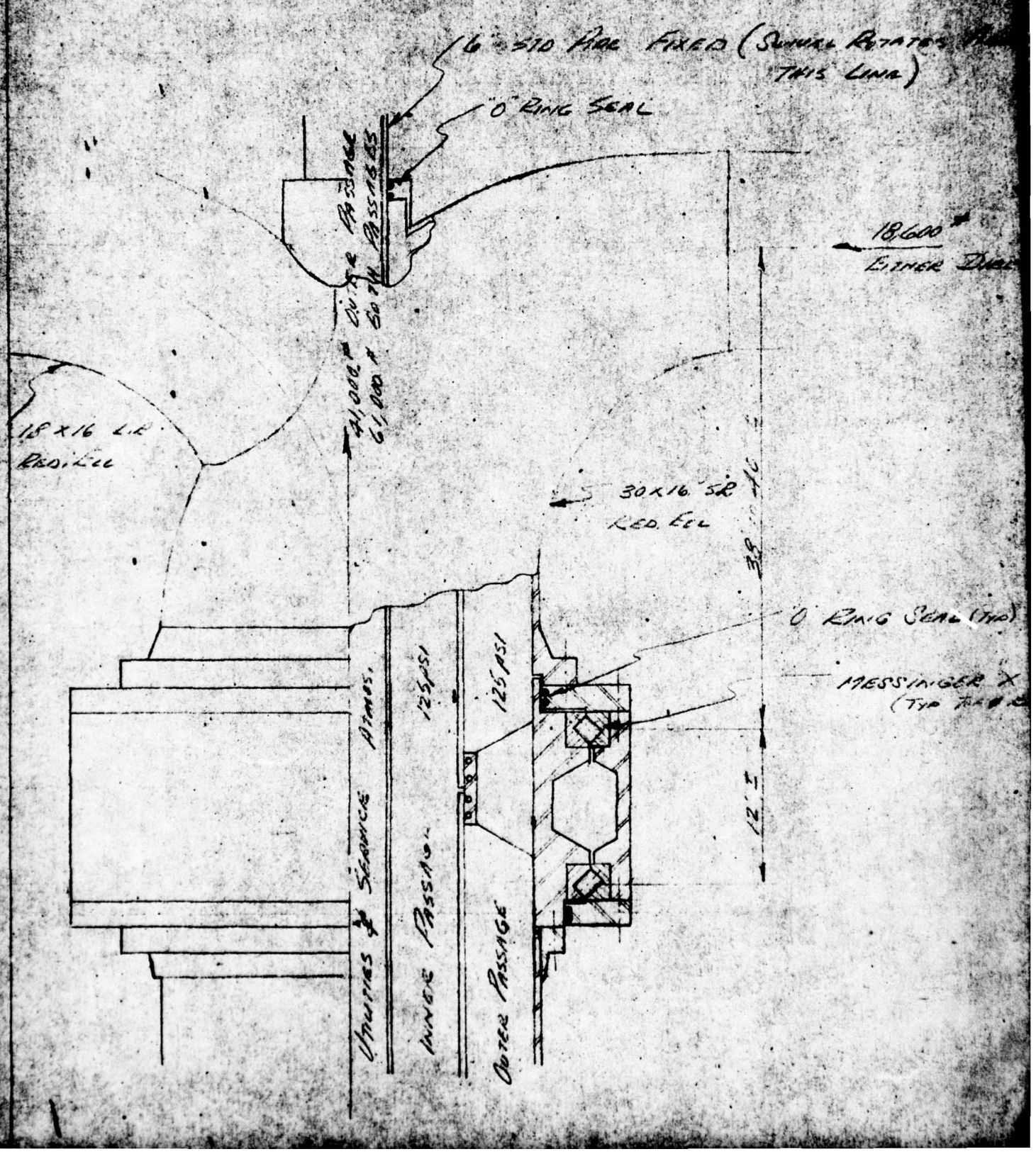
TYPICAL SEAL ASSM.

2

U.S. ARMY E.R.D.L. | SHEET NO. 4 of

SUBJECT: MONO MOORING SYSTEM PRELIMINARY SWIVEL

DRAWING NUMBER | COMPUTER: WAP | CHECKED BY | DATE: 1-12-65



V.O. 26017

for 100 psi ...

OPERATING CONDITIONS

for 100 psi Section

1. FLOW IN OUTER PASSAGE ONLY

VERTICAL THRUST = 41,000 #
OVERHANG LOAD = 18,600 # @ 40"

2. FLOW IN BOTH PASSAGES

VERTICAL THRUST = 61,000 #
OVERHANG LOAD = 22,000 # @ 46"

3. FLOW IN INNER PASSAGE

LOADS EQUAL OR LESS THAN CONDITION 1.

NOTE - ROTATION TO BE ALMOST STATIC CONDITION

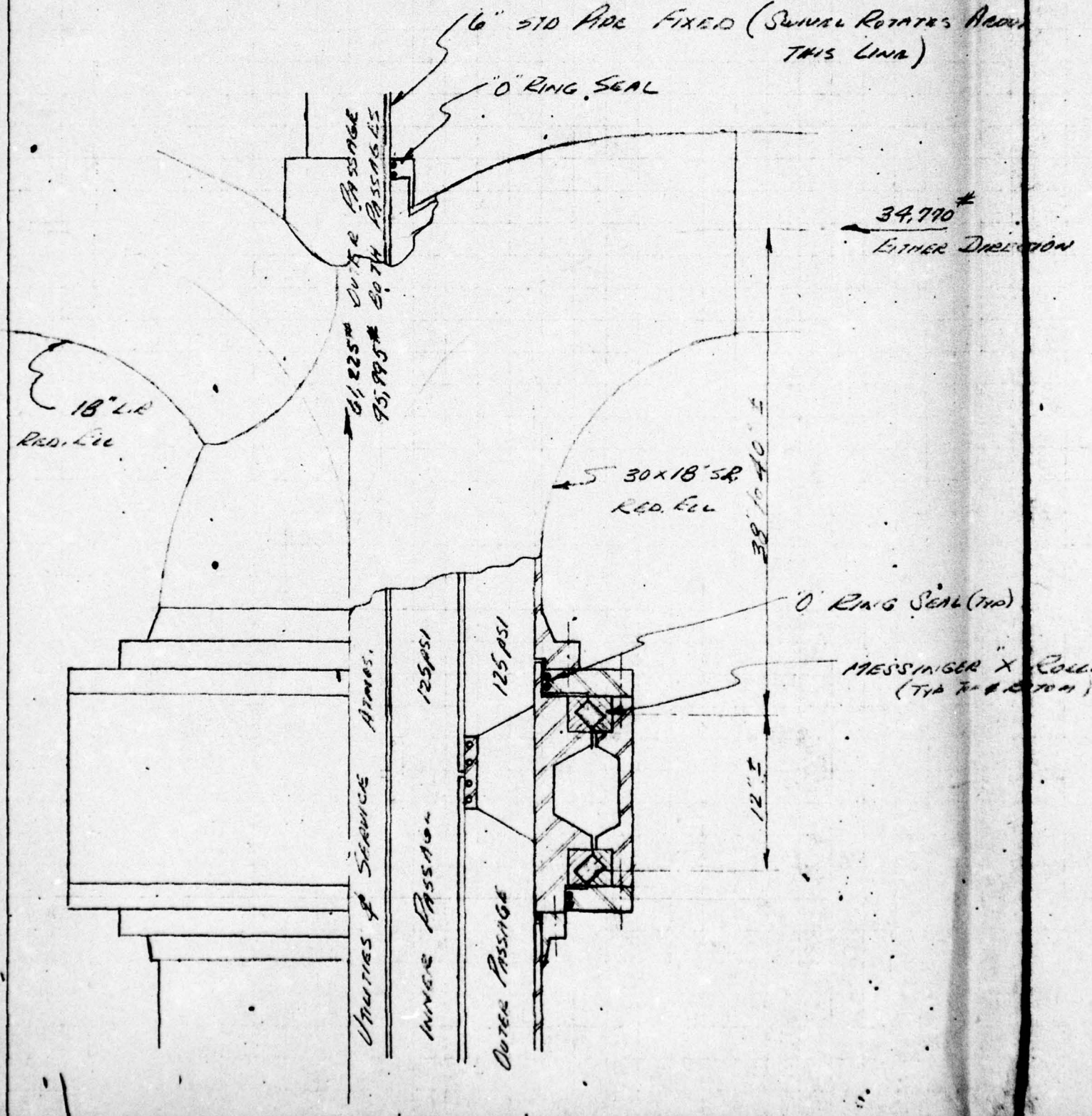
ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S ARMY E.R.D.L.	5 of

SUBJECT: MONO MOORING SYSTEM PRELIMINARY SCHEMATIC

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	MJP		2.22.65



V.O. 56017

for 150 PSI

OPERATING CONDITIONS

for 150 PSI SERVICE

1. FLOW IN OUTER PASSAGE ONLY

VERTICAL THRUST = 61,225 #
OVERHANG LOAD = 34,770 # @ 40" ±

2. FLOW IN BOTH PASSAGES

VERTICAL THRUST = 95,995 #
OVERHANG LOAD = 58,850 # @ 40" ±

3. FLOW IN INNER PASSAGE

LOADS EQUAL OR LESS THAN CONDITION 1.

NOTE: - ROTATION TO BE

HIGHEST STATIC CONDITION

2

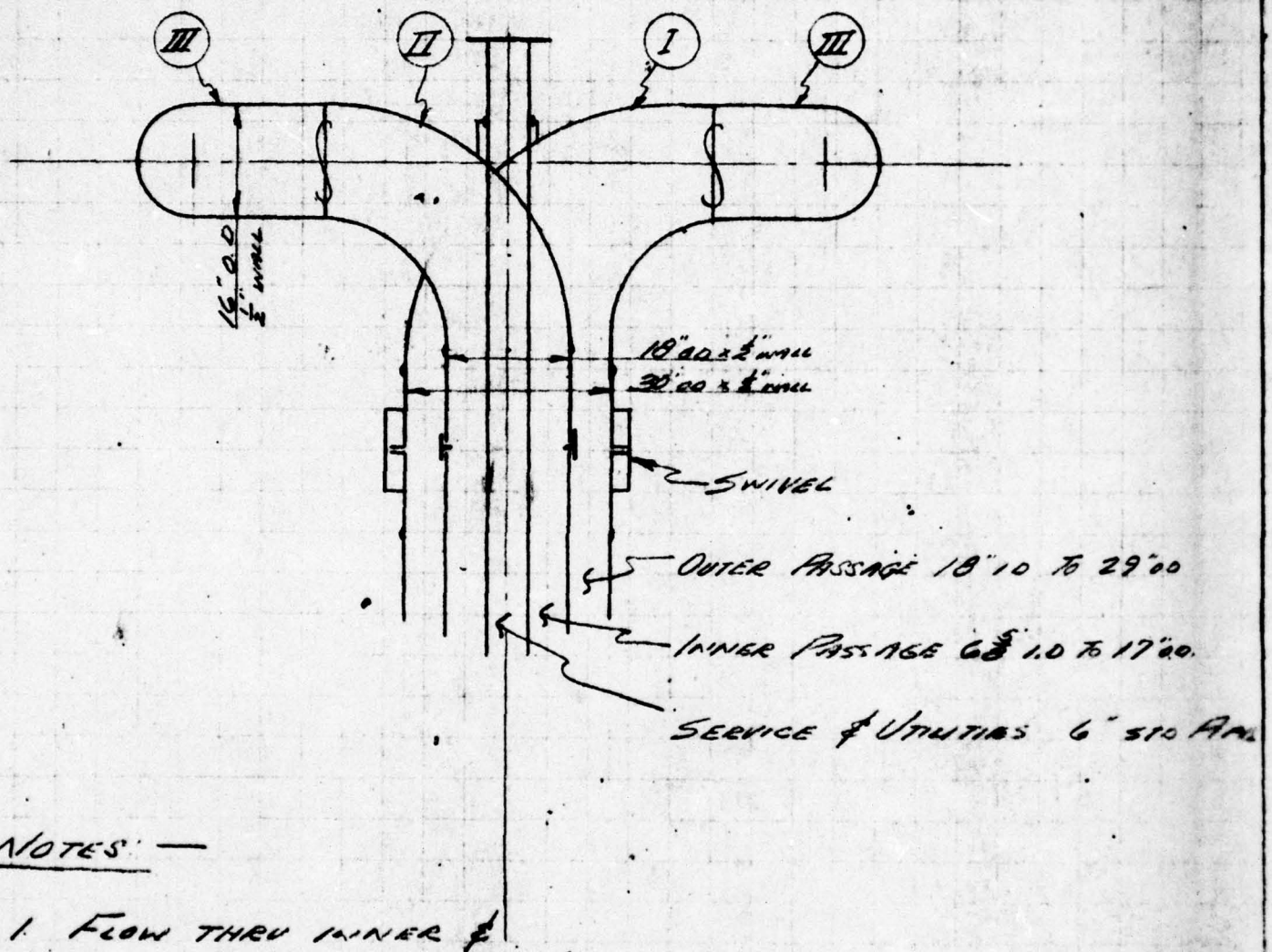
ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S ARMY - ERDL.	1 of

SUBJECT: MONO MOORING SYSTEM - DYNAMIC FLOW LOADS ON S

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	WAP		1-4-65



NOTES: —

1. FLOW THRU INNER & OUTER PASSAGES TO BE 10,500 GPM EACH. TOTAL FLOW 21,000 GPM (30,000 BPH)

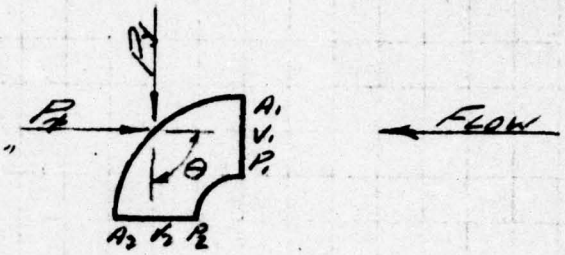
2. FLOW THRU EITHER PASSAGE OR BOTH DURING OPERATING PERIODS

...ODS ON SWIVEL

— REVISED for 150 psi
SEE SHEETS DATED 2/19 & 2/22

FORMULAS:

"BERNOULLI THEOREM"



$$P_x = -\rho Q (V_2 \cos\theta - V_1) + P_1 A_1 - P_2 A_2 \cos\theta$$

$$P_y = \rho Q V_2 \sin\theta + P_2 A_2 \sin\theta$$

Q = FLOW cfs
ρ = DENSITY IN SLUGS PER CU FT = USE 1.935 for WATER
A_1 = AREA SQ FT
A_2 = AREA SQ FT
V_1 = VELOCITY fps
V_2 = VELOCITY fps
P_1 = PRESSURE LBS/SQ FT (100 psi)
P_2 = PRESSURE LBS/SQ FT

(I)

$Q = 23.4$

$A_1 = 1.23$
$V_1 = 19.1$
$P_1 = 14,400$

$A_2 = 2.82$
$V_2 = 8.3$
$P_2 = 14,400$

(Contd)

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY - E.R.D.L.	2 of

SUBJECT: MOOR MOORING SYSTEM - DYNAMIC FLOW LOADS ON

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	WAJ		1-4-65

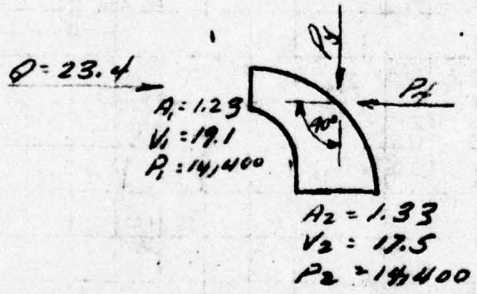
(I) $P_{x_0} = -1.935 \times 23.4 (8.3 \cos 90° - 19.1) + 14,400 \times 1.23 - 14,400 \, 3.8 \cos$

$P_x = 865 + 17,700 - 0 = \underline{18,565 \text{ LBS}}$

$P_y = 1.935 \times 23.4 \times 8.3 \sin 90° + 14,400 \times 2.82 \sin 90$

$P_y = 375 + 40,550 = \underline{40,925 \text{ LBS}}$

(II)



$P_x = 1.935 \times 23.4 (17.5 \cos 90° - 19.1) + 14,400 \times 1.23 - 14,400 \times 1.3 \cos 90$

$P_x = 865 + 17,700 - 0 = \underline{18,565 \text{ LBS}}$

$P_y = 1.935 \times 23.4 \times 17.5 \sin 90° + 14,400 \times 1.33 \sin 90$

$P_y = 770 + 19,150 = \underline{19,920 \text{ LBS}}$

V.O. 56017

Revised

See New Sheets

... Loads On Swivel

... - 14,400 2.8 cos 90°

...2 sin 90

...400 x 1.3 cos 90°

... sin 90

...s

2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

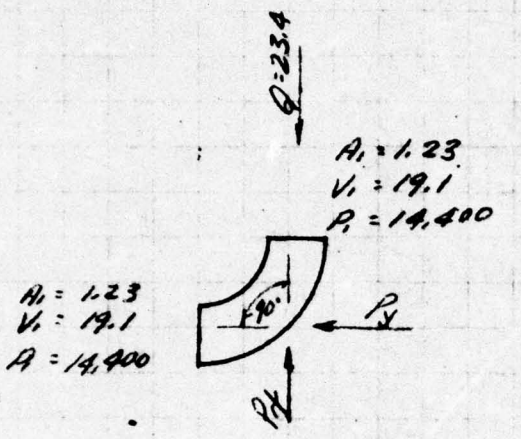
J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. Army ERDL	3 of

SUBJECT: Moored Mooring System - Dynamic Flow Forces On S

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	WAP		1-4-65

(III)



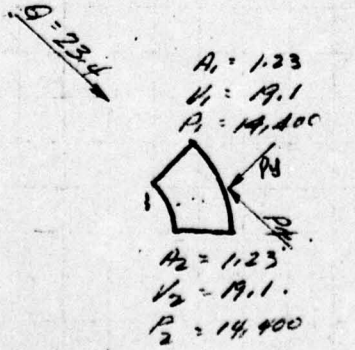
$P_x = -1.935 \times 23.4 (19.1 \sin 90° - 19.1) + 14400 \times 1.23 - 14,400 \times 1.23 \cos 9$

$P_x = 865 + 17,700 - 0 = \underline{18,565 \text{ LBS}}$

$P_y = 1.935 \times 23.4 \times 19.1 \sin 90° + 14400 \times 1.23 \sin 90$

$P_y = 865 + 17,700 = \underline{18,565 \text{ LBS}}$

(IV)



$P_x = -1.935 \times 23.4 (19.1 \cos 45° - 19.1) + 14,400 \times 1.23 - 14,400 \times 1.23 \cos 45°$

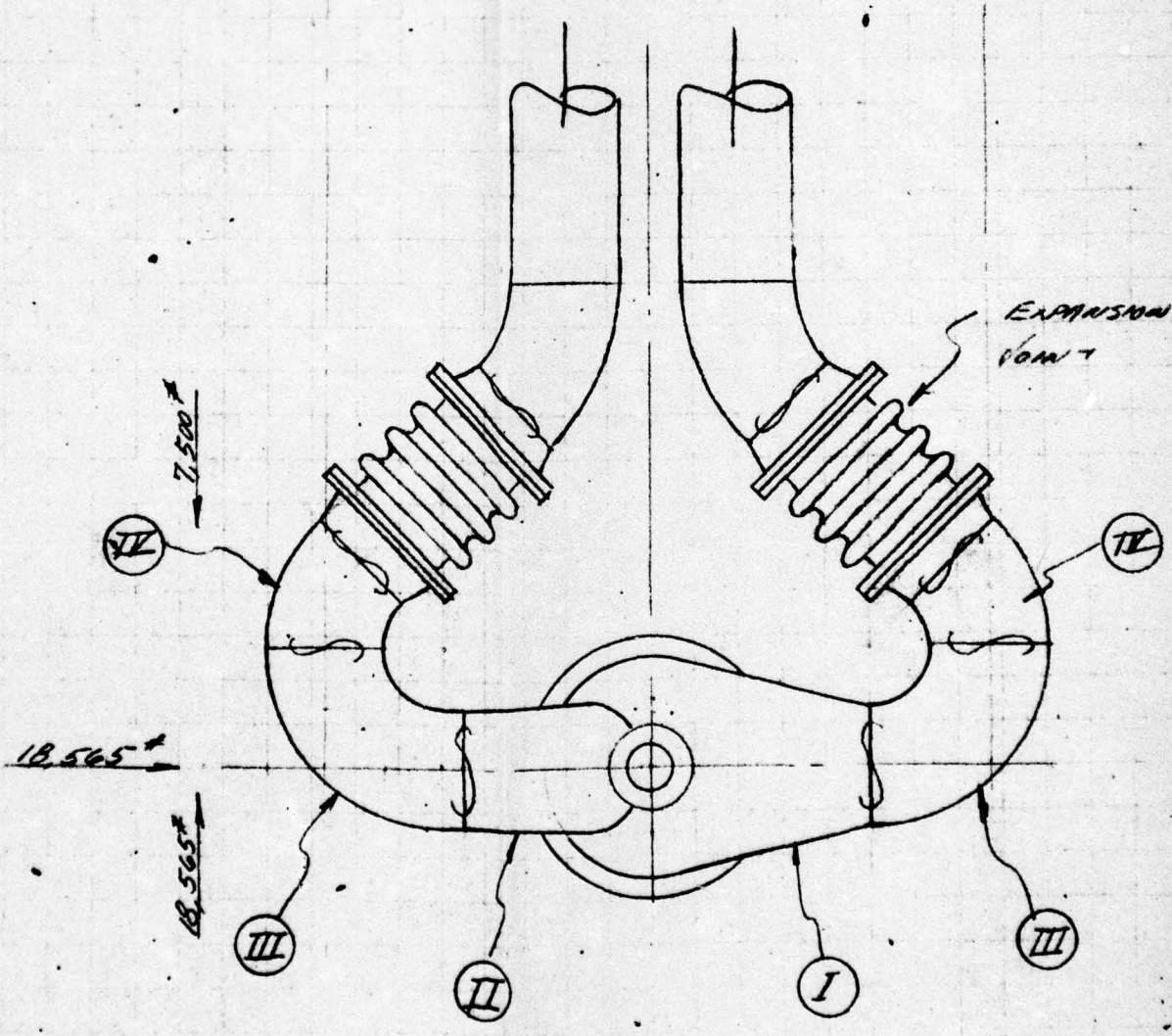
$P_x = 281 + 17,700 - 12,500 = \underline{2,481 \text{ LBS}}$

V.O. 56017

Forces On Swivel

Revised

See New Sheets



-14,400 x 1.3 cos 90°

LBS

3 sin 90

S

400 x 1.3 cos 45°

2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & Co., INC.

COMPANY	SHEET NO
U.S. Army E.R.D.L	4 of

SUBJECT: Mono Mooring System - Dynamic Flow Forces on Sphere

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	aap		1-5-69

(IV) cont'd

$$P_y = 1.935 \times 23.4 \times 19.1 \sin 45^\circ + 14,400 \times 1.23 \cos 45^\circ$$

$$P_y = 612 + 12,500 = \underline{13,112 \text{ LBS}}$$

V.O 56017

...ers On Sawvel

Revised

See New Facts

450

2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5015

J. RAY MCDERMOTT & CO., INC.

COMPANY			SHEET NO
SUBJECT: BERNOULLI TRANSFORMS			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE

Formulas: —

$$R_x = -\rho Q (V_2 \cos\theta - V_1) + P_1 A_1 - P_2 A_2 \cos\theta$$

$$R_y = \rho Q V_2 \sin\theta + P_2 A_2 \sin\theta$$

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 5015

J. RAY McDERMOTT & CO., INC.

COMPANY			SHEET NO
SUBJECT: 30 x 16 Ell 90° Flow 30 to 16			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE

$$P_x = -\rho Q (V_2 \cos\theta - V_1) + P_1 A_1 - P_2 A_2 \cos\theta$$

$$= -1.935 \times 23.4 (19.1 \cos 90° - 8.3) + 14,400 \times 2.8 - 14,112 \times 1.2 \cos 90°$$

$$375 + 40,400 = 40,775 \text{ LBS}$$

$$P_y = \rho Q V_2 \sin\theta + P_2 A_2 \sin\theta$$

$$= 1.935 \times 23.4 \times 19.1 \times 1 + 14,112 \times 1.2 \times 1$$

$$= 856 + 16,900 = 17,756 \text{ LBS}$$

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5015

J. RAY McDERMOTT & CO., INC.

COMPANY			SHEET NO
SUBJECT: 30 x 16 89° flow 30 to 16			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE

$$P_R = \rho Q (V_2 \cos\theta - V_1) + P_1 A_1 - P_2 A_2 \cos\theta$$

$$= 1.935 \times 23.4 (19.1 \cos 89° - 8.3) + 14,400 \times 2.8 - 14,112 \times 1.2 \cos 89°$$

$$390 + 40,400 - 282 = 40,508 \text{ lbs}$$

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 5015

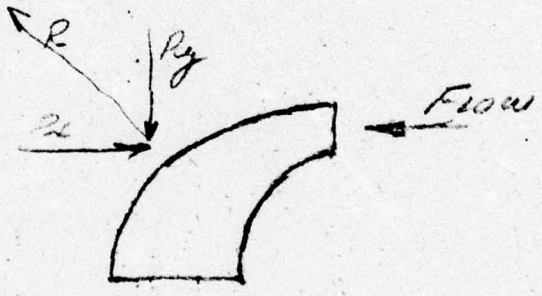
J. RAY MCDERMOTT & CO., INC.

COMPANY			SHEET NO
SUBJECT: 30 x 16 Ell 90° Flow 16 to 30			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE

$$P_y = -\rho Q (V_2 \cos 90° - V_1) + P_1 A_1 - P_2 A_2 \cos\theta$$

$$-1.935 \times 23.4 (8.3 \cos 90° - 19.1) + 14,400 \times 1.2 - 100 \times 2.8 \cos 90°$$

$$856 + 17,600 = 18,406$$



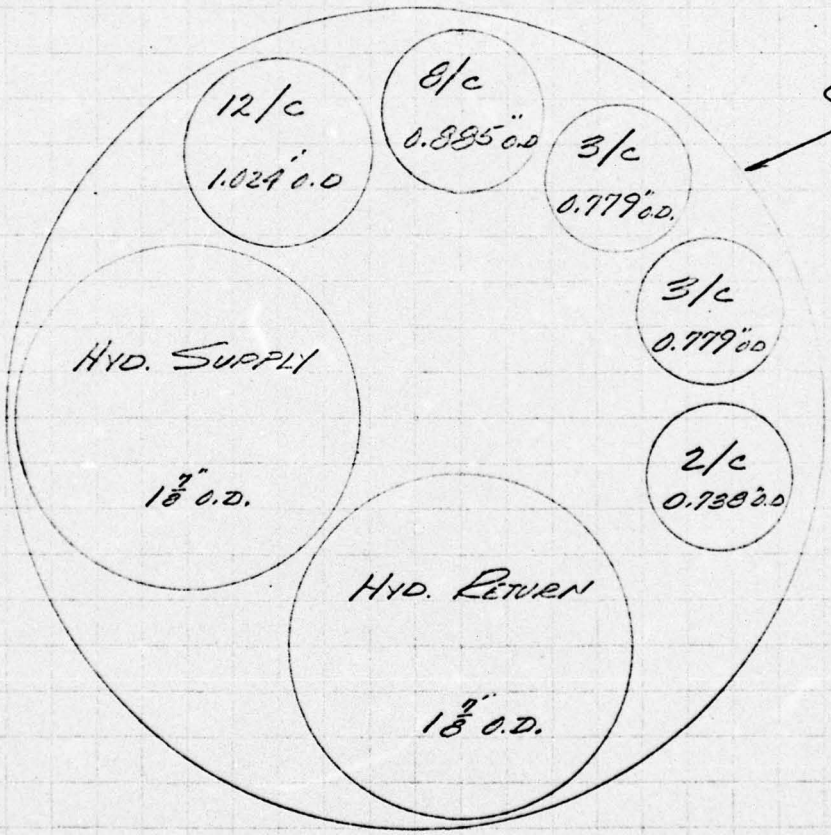
COMPUTATION SHEET
ENGINEERING DEPARTMENT
McD 5011

J. RAY McDERMOTT & CO., INC.

COMPANY: U.S. ARMY ERDL	FIELD:	SHEET NO.: 1 of 1
ICT: MONO MOORING SYSTEM	WELL NO.:	DATE: 11/12/65
DRAWING NO.: 1.056017 GUT LINE ARRGT.	COMPUTER: WAFAC	

SECTION SHOWING AREA REQUIRED FOR HYDRAULIC & ELECTRICAL SERVICE RUNS BETWEEN BUOY MACH'Y COMPARTMENT AND CONTROL CONSOLE

CROSS SECTION



SECTION II

BUOY EQUIPMENT AND SYSTEMS

COMPUTATION SHEET
ENGINEERING DEPARTMENT
4CD 5011

J. RAY MCDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
SUBJECT	WELL NO.	DATE
ING NO.	COMPUTER	

CHAIN STOPPER DESIGN

PITCH DIA .852 D

WIRE DIA .148" = d , d^3 = .0032 , d^4 = .00048

INITIAL TENSION = 10 # = P_i

NO COILS = 64 = N

COIL LENGTH = 9.47"

LENGTH INSIDE HOOKS 12"

OUTSIDE DIA = 1"

INITIAL TENSIONING STRESS = $S = \frac{2.55\,PD}{d^3}$

$$S_i = \frac{2.55 \times 10 \times .852}{.0032}$$

$$S_i = 6800 \text{ psi}$$

SPRING RATE = $P = \frac{G d^4}{8 D^3 N}$

$$P = \frac{9.5 \times 10^6 \times .00048}{8 \times .615 \times 64}$$

$$P = 14.5 \text{ \#/"} \text{ DEFLECTION}$$

TORSIONAL STRESS = S_T = (USE 75,000 MAX)

$$P_{MAX} = \frac{S_T \pi d^3}{16 R \frac{\pi}{4}}$$

$$P_{MAX} = \frac{75000 \times 3.14 \times .0032}{16 \times .426 \times .615}$$

$$P_{MAX} = 96.2 \text{ \#} \text{ (MAX ALLOWABLE SAFE LOAD)}$$

BENDING STRESS = $S_B = \frac{32 PR}{\pi d^3}$

$$S_B = \frac{32 \times 96.2 \times .426}{3.14 \times .0032}$$

$$S_B = 130{,}000 \text{ psi}$$

DEFLECTION = $F = \frac{P_{MAX} - P_i}{P}$

$$F = \frac{96.2 - 10}{} = 6.0"$$

2/12/65
WJ

PITCH DIA .838 = D

WIRE DIA .162 = d, d^3 = .0042, d^4 = .0007

INITIAL TENSION = 10 # = P_i

No COILS = 79 = N

COIL LENGTH 12.96"

LENGTH INSIDE HOOKS $15\frac{1}{4}$" OVER LIMITS for SPACE

OUTSIDE DIA 1"

INITIAL TENSIONING STRESS = $S \frac{2.55PD}{d^3}$

$$S = \frac{2.55 \times 10 \times .838}{.0042}$$

$$S = 5100 \text{ psi}$$

SPRING RATE = $P = \frac{G d^4}{8 D^3 N}$

$$P = \frac{9.5 \times 10^6 \times .0007}{8 \times .59 \times 79}$$

$$P = 17.9 \text{ \#/" DEFLECTION}$$

TORSIONAL STRESS = S_T (USE 75,000 MAX)

$$P_{MAX} = \frac{S_T \pi d^3}{16 \times R \times \frac{\pi}{4}}$$

$$P_{MAX} = \frac{75000 \times 3.14 \times .0042}{16 \times .419 \times 1.15}$$

P_{MAX} = 128 # (MAX ALLOWABLE SAFE LOAD)

BENDING STRESS = $S_B = \frac{32PR}{\pi d^3}$

INITIAL TENSIONING STRESS = $S \frac{2.55PD}{d^3}$

$$S = \frac{2.55 \times 10 \times .838}{.0042}$$

$$S = 5100 \text{ psi}$$

SPRING RATE = $P = \frac{G d^4}{8 D^3 N}$

$$P = \frac{9.5 \times 10^6 \times .0007}{8 \times .59 \times 79}$$

$$P = 17.9 \#/" \text{ DEFLECTION}$$

TORSIONAL STRESS = S_T (USE 75,000 MAX)

$$P_{MAX} = \frac{S_T \pi d^3}{16 \times R \times \frac{r_2}{r_1}}$$

$$P_{MAX} \frac{75000 \times 3.14 \times .0042}{10 \times .419 \times 1.15}$$

$$P_{MAX} = 128 \# \text{ (MAX ALLOWABLE SAFE LOAD)}$$

BENDING STRESS = $S_B = \frac{32 PR}{\pi d^3}$

$$S_B = \frac{32 \times 128 \times .419}{3.14 \times .0042}$$

$$S_B = 130,000 \text{ psi}$$

DEFLECTION = $F = \frac{P_{MAX} - P_1}{P}$

$$F = \frac{128 - 10}{17.9} = 6.6"$$

COMPUTATION SHEET
ENGINEERING DEPARTMENT
MCD 5011

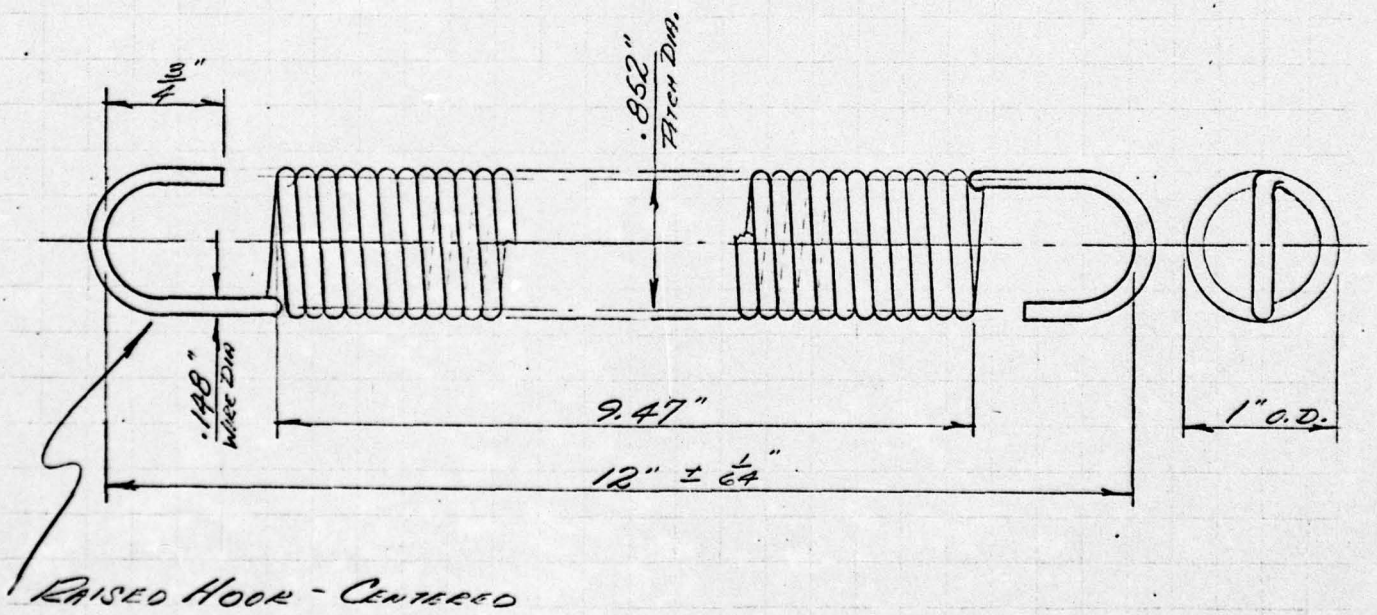
J. RAY McDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
U.S. ARMY - ERDL		1 of 1
PROJECT	WELL NO.	DATE
MOORING SYSTEMS - CHAIN STOPPER		2/12/65
DRAWING NO.	COMPUTER	
J.O 56017 SPRING CALCULATION	WHP	

MATERIAL:- SAE 30316 STAINLESS or AS140 MONEL

WORKING SPECIFICATIONS:-

OUTSIDE DIA	1"
PITCH DIA	.852"
WIRE DIA	.148"
INITIAL TENSION	10 LBS
NO COILS	64
COIL LENGTH	9.47"
LENGTH INSIDE HOOKS	12"
APPROX SPRING RATE	14.5 LBS/" DEFLECTION
TOTAL DEFLECTION	6" MAX



RAISED HOOK - CENTERED

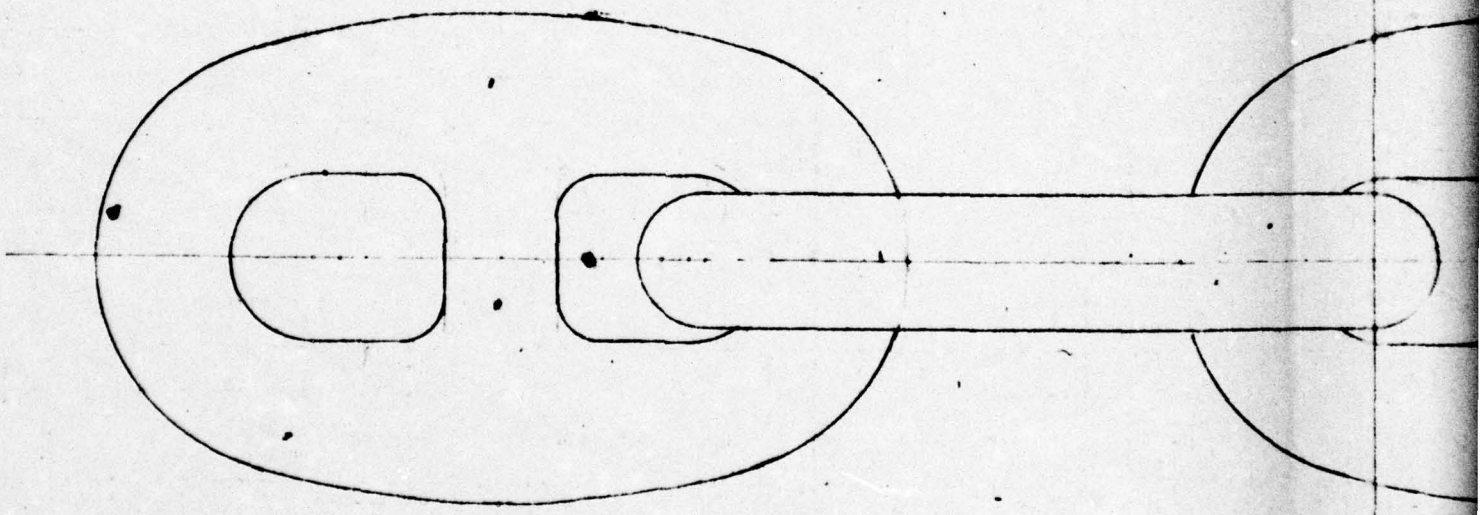
NOTE: TOTAL LOAD @ 6" DEFLECTION 95# ± 5%

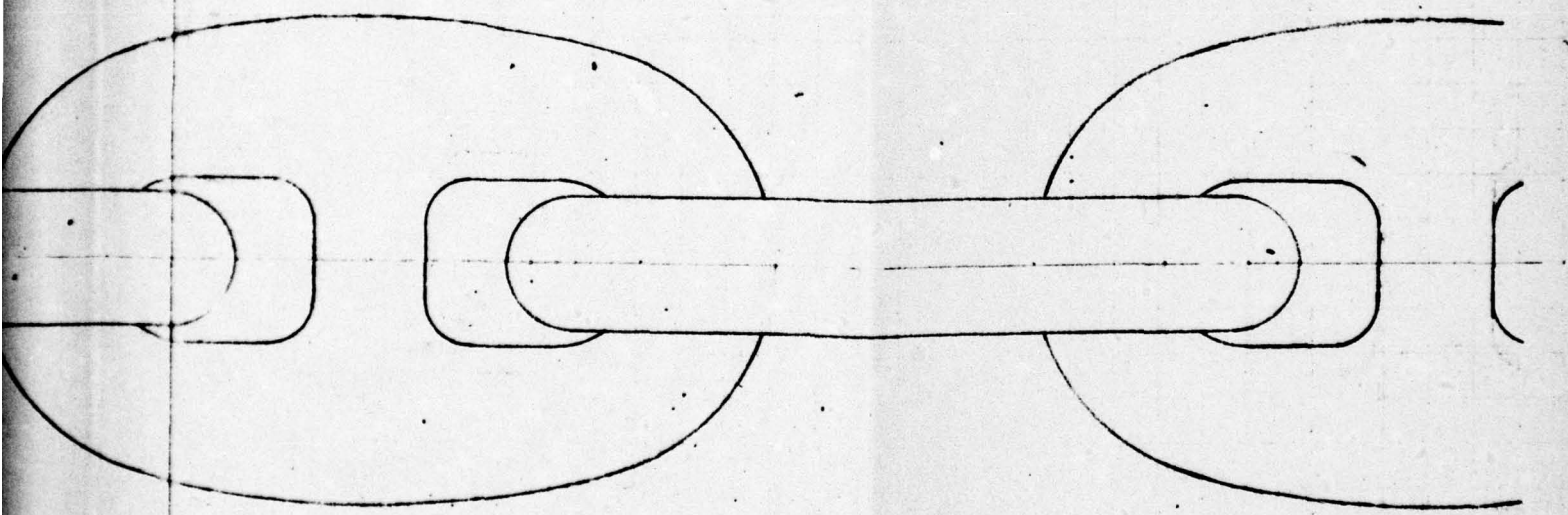
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY MCDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY - E.R.D.L	
SUBJECT: MONO MOORING SYSTEM - ANCHOR CHAIN	
DRAWING NUMBER	COMPUTER: WAP / CHECKED BY / DATE

3" DIA STUD LINK CHAIN.
(BALT OR EQUAL)





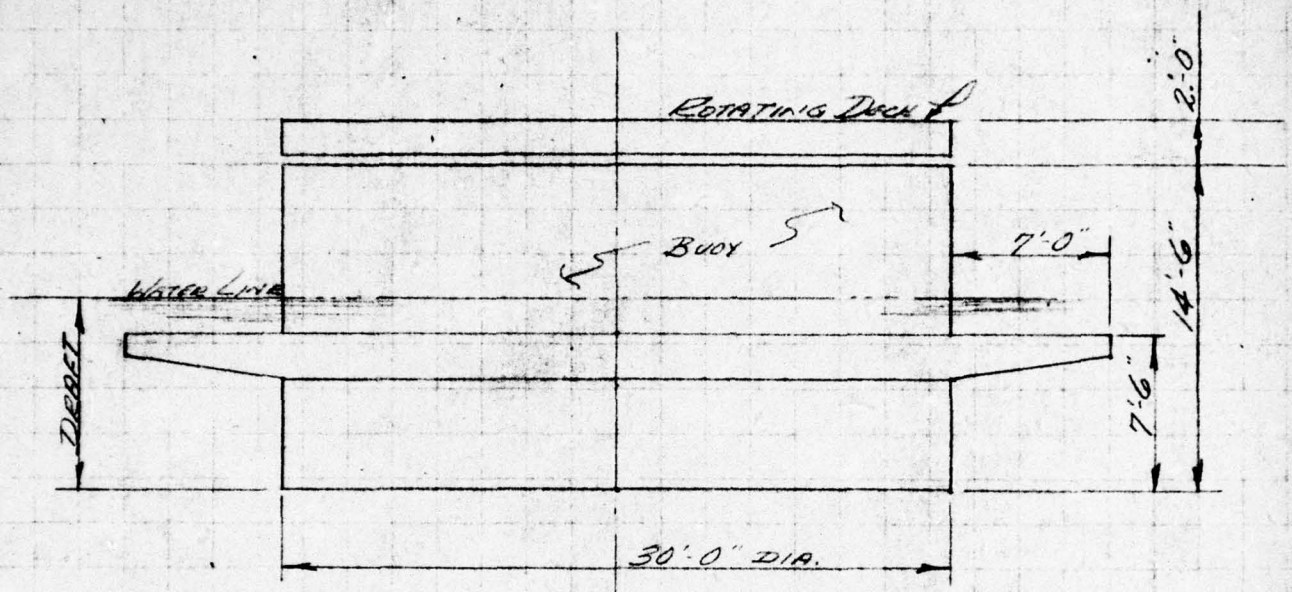
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S ARMY - ERDL	

SUBJECT: MONO MOORING SYSTEM - BUOY DRAFT

JOB NUMBER	COMPUTER	CHECKED BY	DATE
V.O. 56017	MAP		4-23-65



LOCATION WATER DEPTH	BUOY DRAFT (PRE LOADED)	PRE LOAD
60'	6.7'	
100'		
150'	11.5'	

NOTE: MOORED LOAD INCREASES TOTAL DRAFT OF BUOY.

COMPUTATION SHEET
NGINEERING DEPARTMENT
MCD 5011

J. RAY MCDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
BJECT	WELL NO.	DATE
DRAWING NO.	COMPUTER	

BOGIE WHEEL DESIGN

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

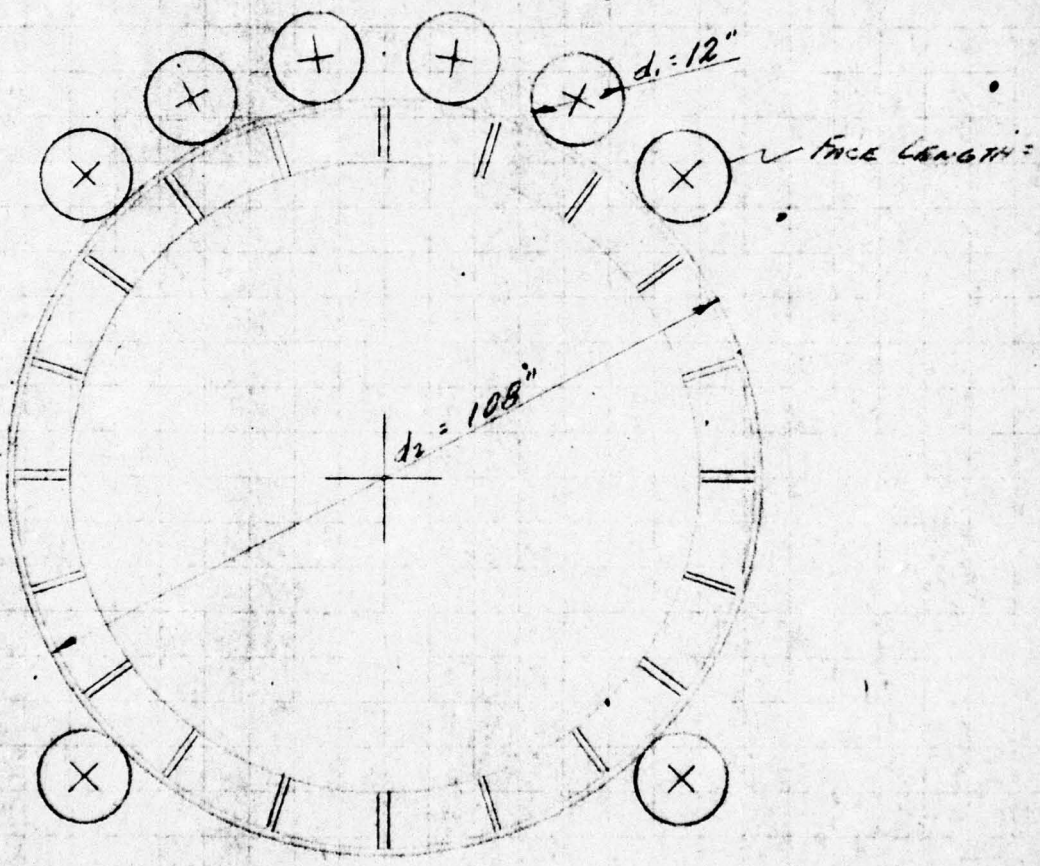
J. RAY McDERMOTT & CO., INC.

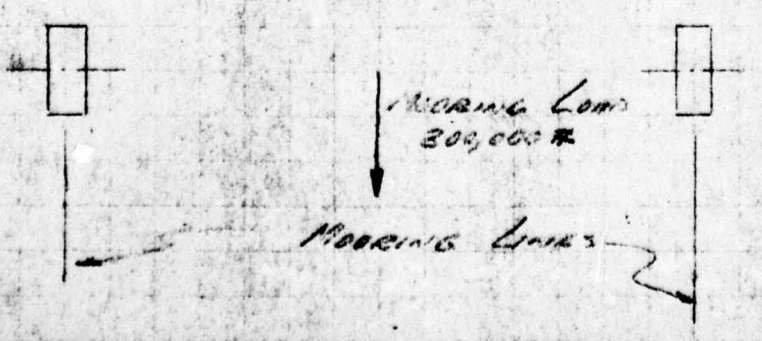
COMPANY	SHEET NO
U.S ARMY E.R.D.L	1 of

SUBJECT: Moho Mooring System - Bogie Wheel Loads

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	MJP		1-14-65

INNER RACE FOR HORIZONTAL LOAD





V.O 56017

PRELIMINARY

PRESSURES & AREAS OF CONTACT / BOGIE

L LOAD

TOTAL LOAD = 300,000 #
ACTIVE WHEELS = 6
LOAD / WHEEL = $\frac{300,000}{6}$ = 50,000 #

formula :-

LOAD CAPACITY PER LIN. INCH OF WHEEL
(AISC) # 5.19

$$F_p = \left(\frac{F_y - 13,000}{20000}\right) 660\, d$$

AREAS OF CONTACT AND PRESSURES
(KENT 8-36)

$$s = .591 \sqrt{F_p E \left(\frac{d_1 + d_2}{d_1 \times d_2}\right)}$$

$$b = 2.15 \sqrt{\frac{F_p}{E} \left(\frac{d_1 \times d_2}{d_1 + d_2}\right)}$$

$$y = \frac{2(1-\nu^2)}{E} \frac{F_p}{\pi} \left(\frac{2}{3} + \log_e \frac{2d_1}{b} + \log_e \frac{2d_2}{b}\right)$$

F_y = YIELD STRENGTH OF STEEL = 46,000
F_p = WHEEL LOAD CAPACITY PER LIN. IN.
S = MAX PRESSURE AT ℄ CONTACT (WHEEL)
E = MODULUS OF ELASTICITY = 30,000,000
y = COMBINED DEFORMATION OF BOTH WHEEL & RAIL

ALL FIGURES IN INCHES & POUNDS

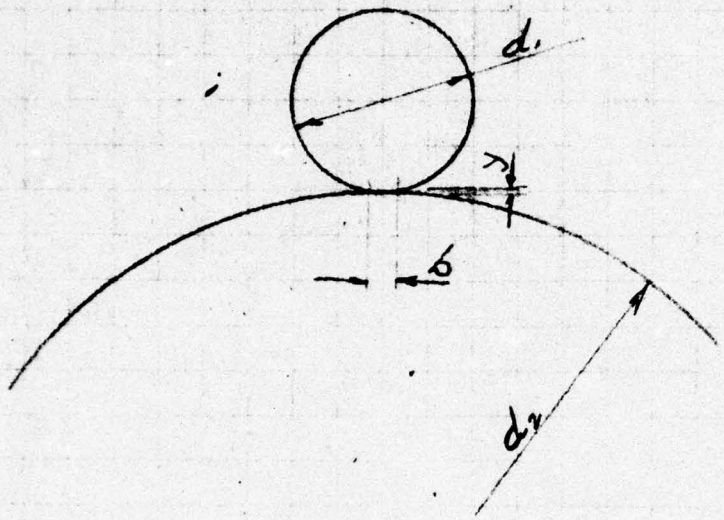
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY - ERDL	2 of

SUBJECT: MONO MOORING SYSTEM - BOGIE WHEEL LOADS

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	WMP		1-15-65



TOTAL DEFORMATION OF BOTH BODIES

$$y = \frac{2(1-.3^2)}{E} \frac{F_n}{\pi} \left(\frac{2}{3} + \log_e \frac{2d_1}{b} + \frac{2d_2}{b} \right)$$

$$y = \frac{2(1-.3^2)}{30\times10^6} \times \frac{11,100}{3.14} \left(\frac{2}{3} + \log_e \frac{2\times12}{.063} + \frac{2\times108}{.063} \right)$$

$$y = .003"$$

LOADS

PRELIMINARY

ALLOWABLE LOAD PER INCH OF FACE WIDTH OF WHEEL

$$F_p = \left(\frac{F_t - 13{,}000}{24{,}000}\right) 660 d_1$$

$$F_p = \left(\frac{42{,}000 - 13{,}000}{24{,}000}\right) 660 \times 12 = 11{,}500\ \#$$

FACE WIDTH OF WHEEL

$$W = \frac{LOAD}{F_p}$$

$$W = \frac{50{,}000}{11{,}500} = 4.35"\ \text{USE}\ \underline{4\tfrac{1}{2}"}$$

ACTUAL F_p = $\frac{LOAD}{W}$

$$\frac{50000}{4.5} = 11{,}100\ \#$$

MAX. UNIT STRESS @ CONTACT POINT

$$S_c = .591 \sqrt{F_p \times E \left(\frac{d_1 + d_2}{d_1 \times d_2}\right)}$$

$$S_c = .591 \sqrt{11{,}100 \times 30 \times 10^6 \left(\frac{12 + 108}{12 \times 108}\right)}$$

$$S_c = 103{,}000\ PSI$$

CONTACT WIDTH

$$b = 2.15 \sqrt{\frac{F_p}{E} \left(\frac{d_1 \times d_2}{d_1 + d_2}\right)}$$

$$b = 2.15 \sqrt{\frac{11100}{30 \times 10^6} \left(\frac{12 \times 108}{12 + 108}\right)}$$

$$b = .063"$$

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

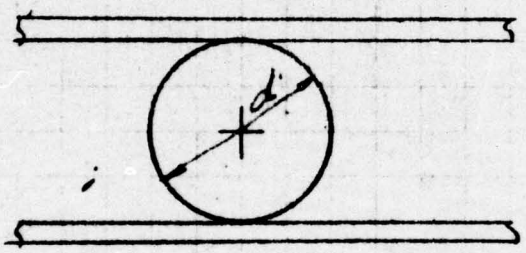
J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY - ERDL	3 of

SUBJECT: MONO MOORING SYSTEM - BOGIE WHEEL LOAD

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	WJP		1-18-65

OUTER RACE FOR VERTICAL LOAD



MAX. UNIT STRESS @ CONTACT POINT

$$S_c = .591\sqrt{\frac{F_n E}{d}} = .591\sqrt{\frac{7200 \times 30 \times 10^6}{12}}$$

$$S_c = 79{,}000 \text{ psi}$$

CONTACT WIDTH

$$b = 2.15\sqrt{\frac{F_n d}{E}} = 2.15\sqrt{\frac{7200 \times 12}{30 \times 10^6}}$$

$$b = .115$$

LOAD

5

LOAD

PRELIMINARY

TOTAL VERTICAL LOAD = 195,000 #

USE SAME DIA & WIDTH WHEEL AS FOR HORIZONTAL LOAD
12" DIA x 4" WIDE

F_p = 11,500 #/lin in. from Sheet 2

ALLOWABLE LOAD PER WHEEL

$F = 11{,}500 \times 4 = 46{,}000$ #

NO WHEELS REQD

$$N = \frac{195{,}000}{F} = \frac{195{,}000}{46{,}000} = 4.24$$

USE MIN 5 WHEELS
DESIGN IN PANS, USE 6 WHEELS

LOAD PER WHEEL

$$\text{LOAD} = \frac{195{,}000}{6} = 32{,}500 \text{ #}$$

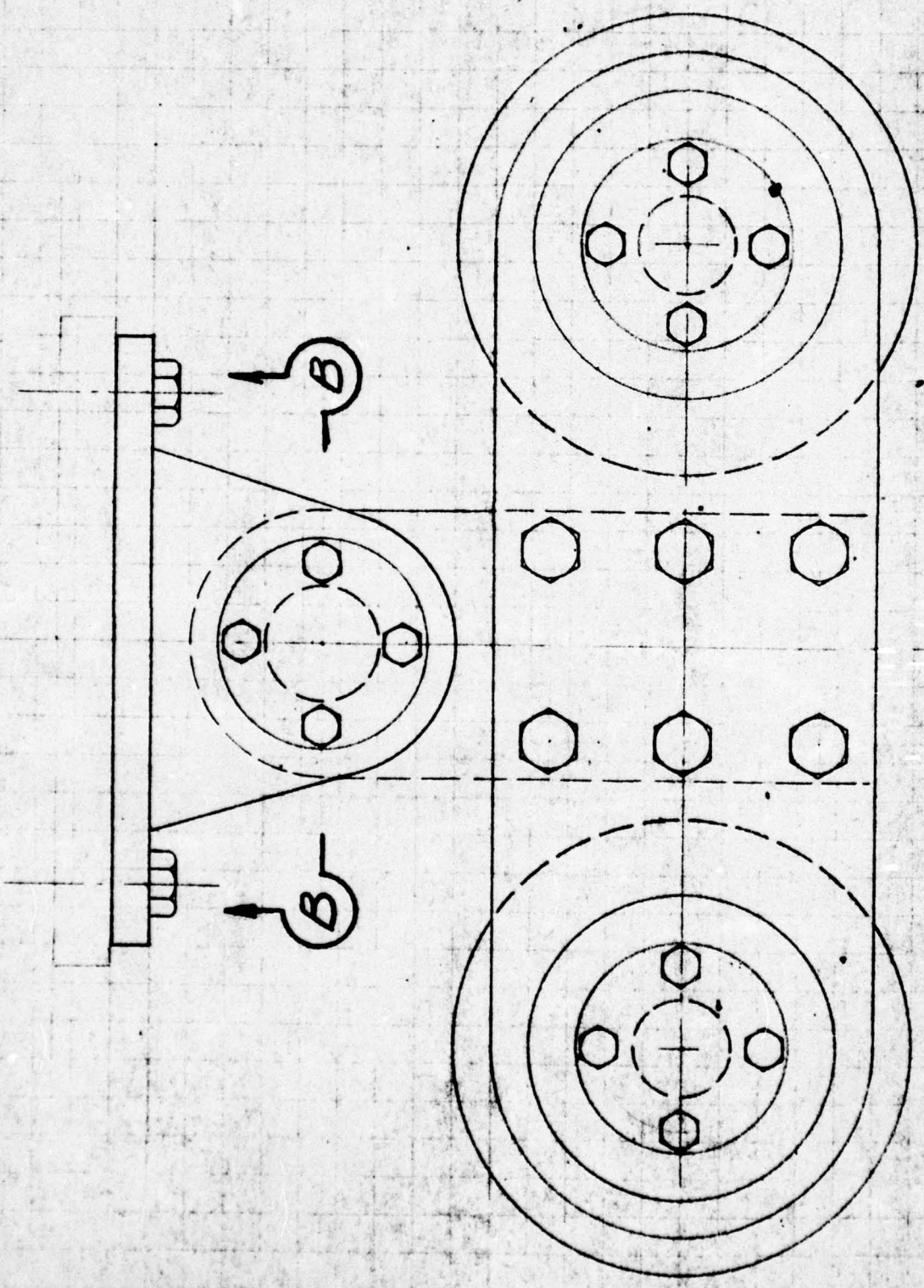
ACTUAL $F_p = \frac{\text{LOAD}}{W}$

$$\frac{32{,}500}{4.5} = 7{,}200 \text{ #/in}$$

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. Army - ERDL	4 of
SUBJECT	
Mono Mooring System - Bogie Design	
DRAWING NUMBER	COMPUTER: WQP
CHECKED BY	DATE: 1-21-65

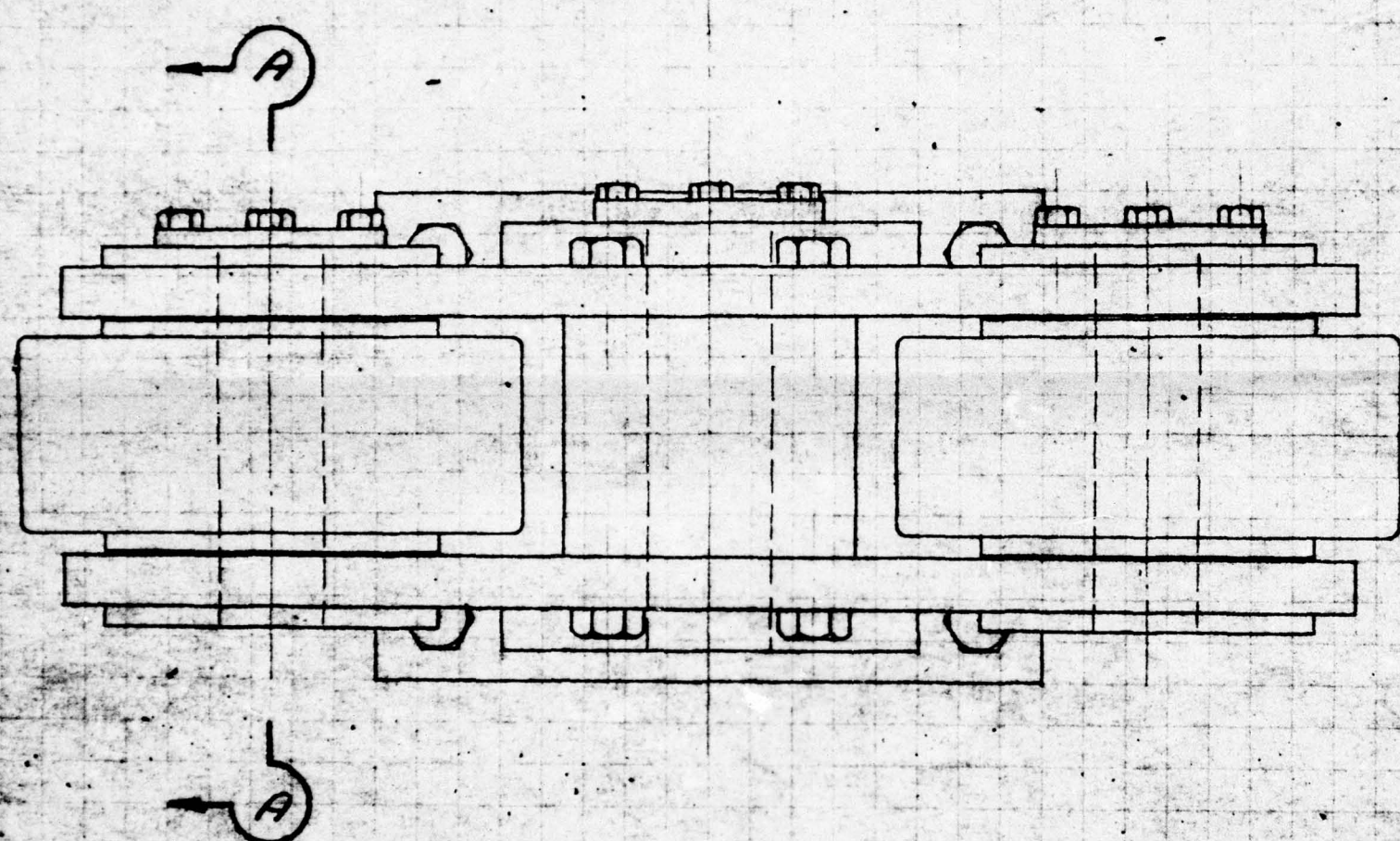


PLAN

56017

PRELIMINARY

PLAN



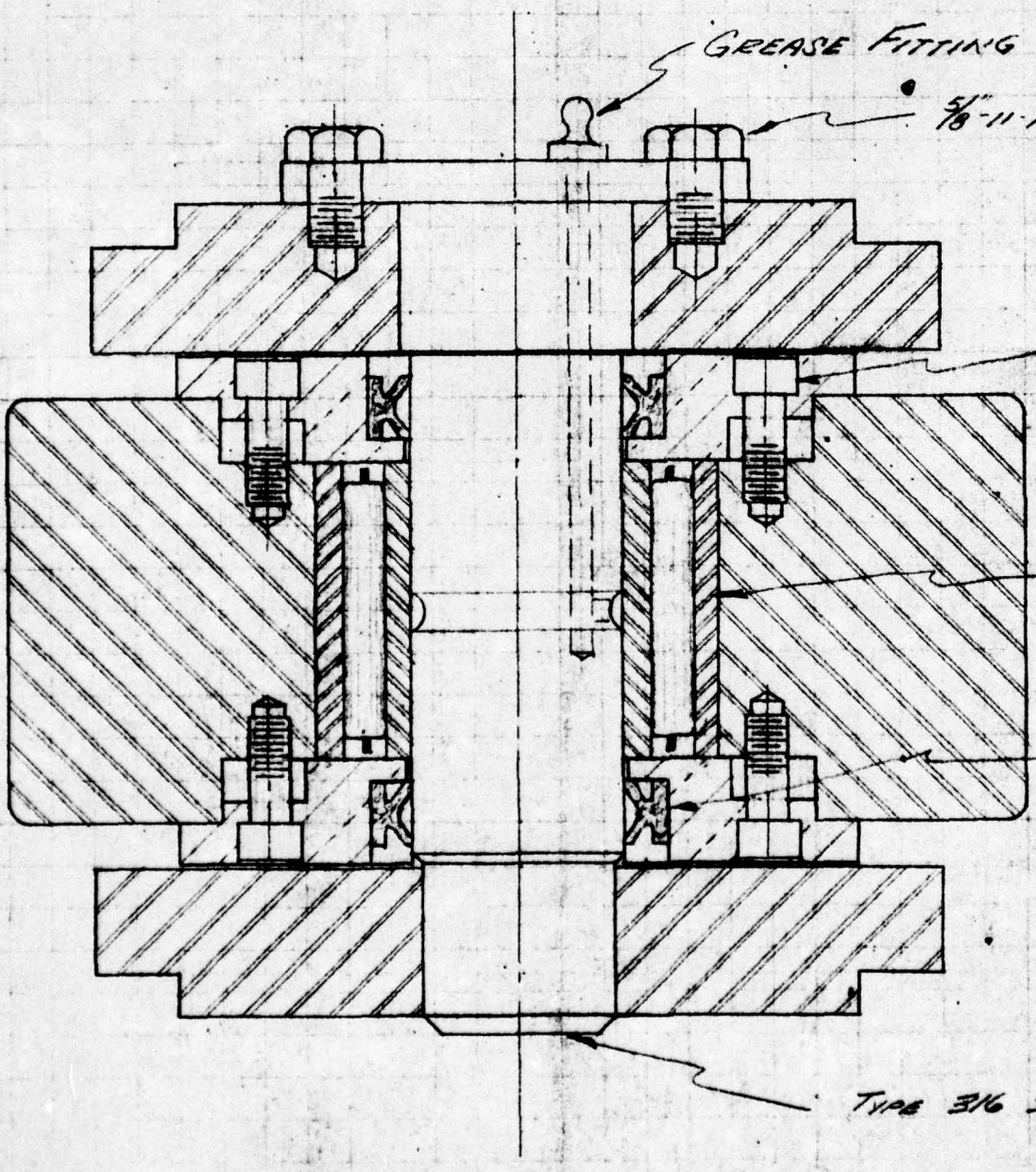
ELEVATION

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & CO., INC.

McD 14003

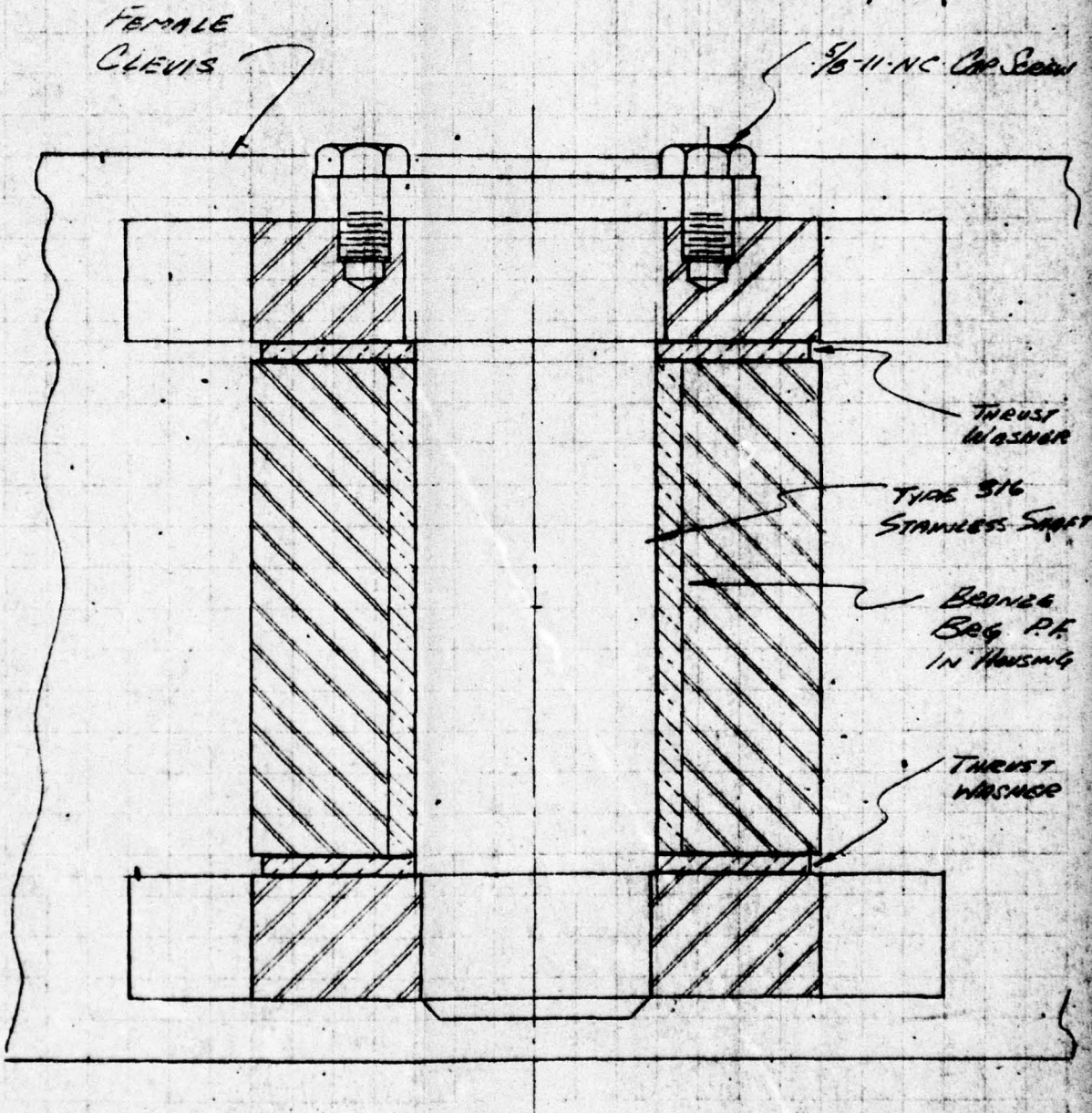
COMPANY	SHEET NO
U.S ARMY - EROL	5 of
SUBJECT	
MOORING SYSTEM - BOGIE DESIGN	
DRAWING NUMBER / COMPUTER: WAP / CHECKED BY / DATE: 1-21-65	



SECTION A-A

56017

PRELIMINARY



SECTION B-B

2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

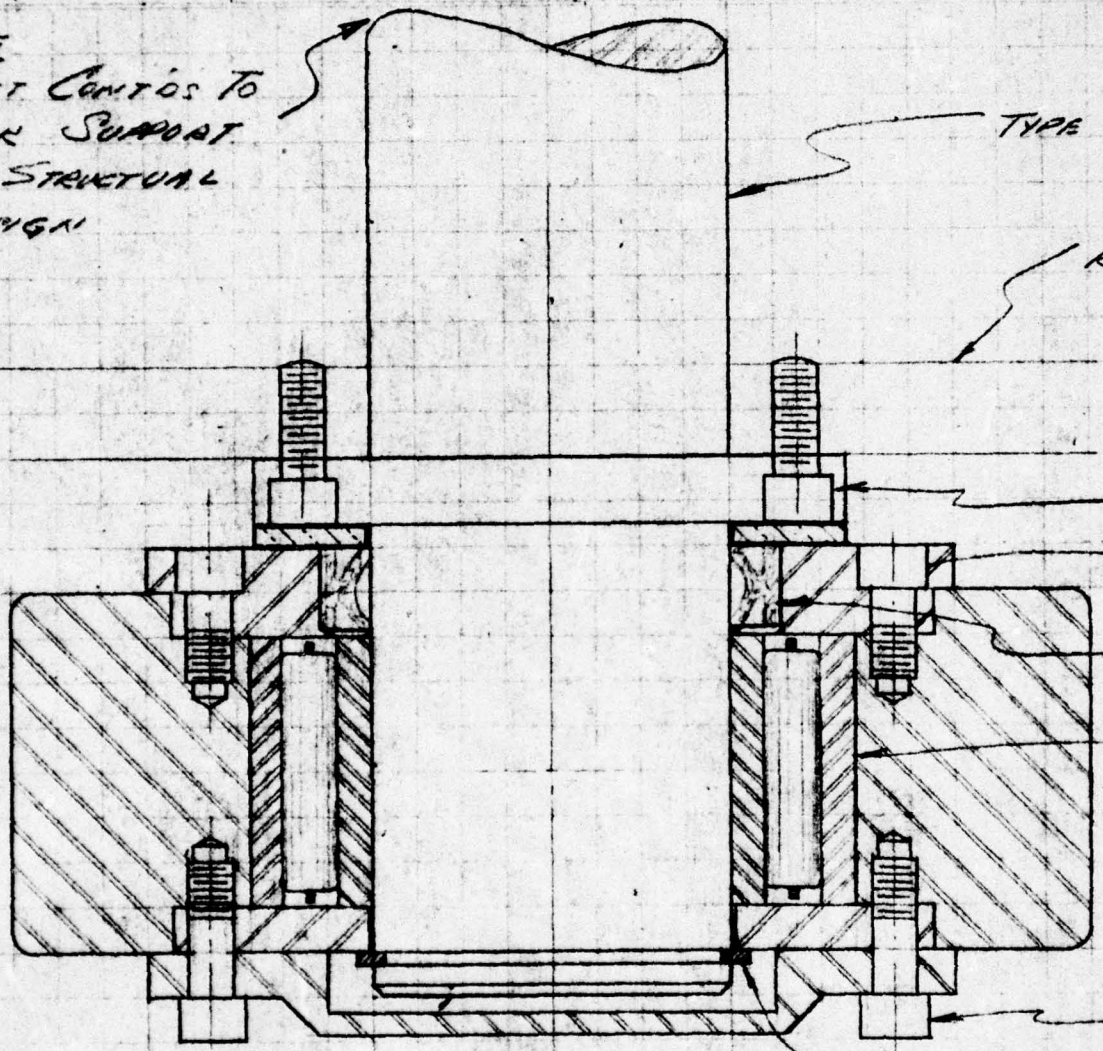
J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S ARMY - ERDL	6 of

SUBJECT
MONO MOORING SYSTEM - BOGIE DESIGN

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE

NOTE
SHAFT CENTERS TO BACK SUPPORT PER STRUCTURAL DESIGN



OUTER RACE BOGIE WHEEL

for VERTICAL FORCES

56017

PRELIMINARY

STAINLESS SHAFT

ATING DECK STRUCTURE

5/8" CAP SCREW

½" CAP SCREW

GARLOCK SEAL
53X1559R2

AMERICAN ROLLER BRG
ACS-271

½" CAP SCREW

RETAINING RING
00

TEL

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & CO. INC.

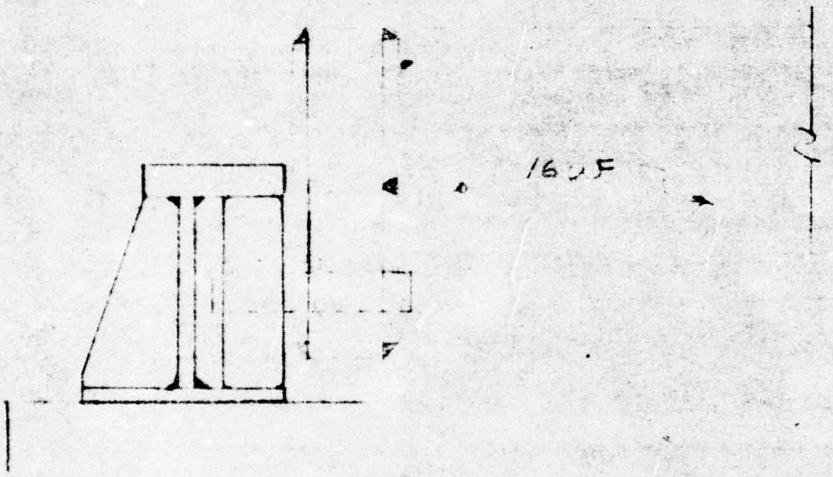
COMPANY: USA ERDL

SHEET NO. 9

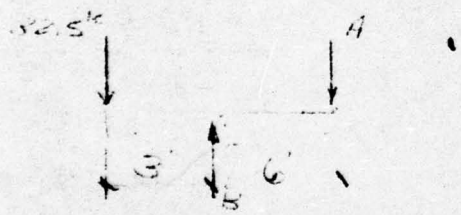
SUBJECT: MONO-MOORING SYSTEM

JOB 56017 ANDREWS 7/21/65

PRELIMINARY DESIGN OF SUPPORT FOR OUTER-RACE BOGIE WHEELS



CHECK PIN & SIDE AS



$A = \frac{32.5(3)}{6} = 16.3^k$ ✓

$B = 16.3 + 32.5 = 48.8^k$ ✓

TRY 3¼" ⌀ PIN

$M = 32.5(3) = 97.5^{'k} < 101.1$ O.K.

THICKNESS OF PL REQ'D

$t = \frac{48.8}{104} = .46$ USE ¾" PL

$S = 12^k$ for 70,000 tensile

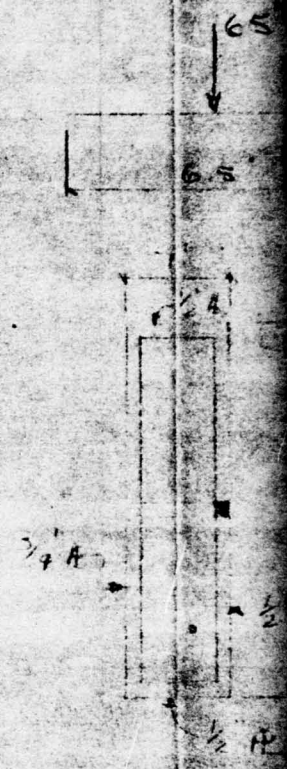
$d = \sqrt[3]{\frac{M}{.098 \times S}}$

$d = \sqrt[3]{\frac{97.5}{.098 \times 12}}$

$d = 4.3''$ pin

$t = \frac{B}{S \times d} = \frac{48.8}{12 \times 4.3} = .945''$

CONSIDER



NOTE: PU

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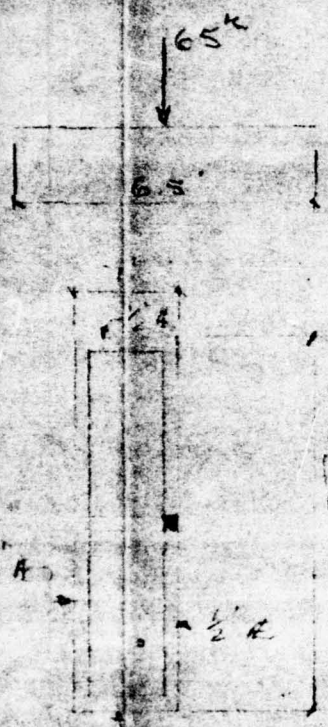
CONSIDER BENDING IN A GIRDER



MAX M = 3(65)(6.5) = 1270 IN-K

DETERMINE MOMENT OF INERTIA

$I = \frac{7(23)^3}{12} = 7097$

$\frac{5.5(21.5)^3}{12} = 4555$

$I = 2,542 \text{ IN.}^4$

$f = \frac{Mc}{I} = \frac{1,270(11.5)}{2,542} = 5.75 \text{ KSI}$

$I = \frac{7(23)^3}{12} = 7097$

$= \frac{5.75(22)^3}{12} = 5102$

$I = 1,995 \text{ IN.}^4$

$f = \frac{Mc}{I} = \frac{1,270(11.5)}{1,995} = 7.31 \text{ KSI}$ OK.

USE PUT STIFFNERS NEAR PIN LOCATION TO DISTRIBUTE SHEAR

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COMPUTATION SHEET
ENGINEERING DEPARTMENT
CD 5011

J. RAY McDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
SUBJECT	WELL NO.	DATE
DRAWING NO.	COMPUTER	

BUOY SYSTEMS

ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY - ERDL	

SUBJECT: MONO MOORING SYSTEM — DERRICK HOIST & MACH

NUMBER	COMPUTER	CHECKED BY	DATE
J.O. 56017	WJP		5-4-65

AIR VS HYDRAULI

		AIR
		IR. #K6U
SPACE REQUIREMENT	(PRIME MOVER & POWER UNIT)	
	(HOIST)	46½" L. x 31¾" W. x 36" H.
WEIGHT	(PRIME MOVER & POWER UNIT) DRY	5000 #
	(HOIST)	1315 #
	(HYDRAULIC FLUID)	NONE
HOIST CAPACITY	(LINE PULL)	
	" "	10,700 # w/200 CABLE
	(DRUM CAP.) ¾ CABLE	200 FT for RATING (470'
	(LINE SPEED FT/MIN)	65'/MIN.
	" " "	
	(PRESSURE & GPM)	125 psi & 360 cfm
	(H.P. REQD)	
BRAKE CAPACITY		
CONTROLS		MANUAL VALVE INTEGRAL
FLOW LINES	(SUPPLY)	1½" IPS
	(RETURN)	NONE
CLEANLINESS REQUIREMENTS		FILTER ON COMP. ROTARY
SYSTEM COMPLEXITY		SINGLE LINE SYSTEM HI FLOW LUBRICATOR
FLEXIBILITY & RELIABILITY		IMEDIATE RESPONSE EXT. BRAKE SUBJECT TO CO

& MACHINERY

DRAULIC SYSTEM

	HYDRAULIC	
K6U	MARCO # W0960	GEARMATIC # 22S
31¾" W. x 36" H.	36" L. x 33" W. x 28¾" H.	31¼ L. x 23½ W. x 21¼ L.
000 #	3600#	
15 #	1000#	825#
IE	130 GAL @ 7.5#/G = 975#	200 GAL @ 7.5#/G = 1500#
	(1500 PSI MAX)	(1500 PSI) (1900 PSI MAX)
	14,800# BARE DRUM	16,500# 22,000# BARE DRUM
0# w/200 CABLE	10,000# FULL DRUM	9,100# 12,700# FULL DRUM
for RATING (470' FULL)	200 FT	212 FT
/MIN.	88 GPM 46 GPM	46 GPM 65 GPM
	50'/MIN 87'/MIN BARE D.	40'/MIN. 60'/MIN BARE D
	70'/MIN 123'/MIN FULL D.	72'/MIN 104'/MIN FULL D.
PSI & 360 cfm	1500 PSI & 46 GPM	1500 PSI & 46 GPM 1900 PSI & 65 GPM
	54 HP	54 HP 59 HP
	15,000# LINE PULL MEAN DRUM CAP.	
ALVE INTEGRAL	MANUAL 4 WAY - 3 POSITION PRESSURE REGULATING CONTROLS	MANUAL 4 WAY - 3 POSITION PRESSURE REGULATING CONTROLS
IPS	1¼" IPS	1¼" IPS
	1¼" IPS	1¼" IPS
COMP INTAKE	25 MICRON FILTER	25 MICRON FILTER
LINE SYSTEM LUBRICATOR	SUPPLY & RETURN LINES PRESSURE CONTROLS	SUPPLY & RETURN LINES PRESSURE CONTROLS
RESPONSE SUBJECT TO [illegible]	IMEDIATE RESPONSE DESIGNED FOR MARINE SERVICE	IMEDIATE RESPONSE USED FOR OFFSHORE OIL INDUST.

2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14002

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY - ERDL	

SUBJECT: MONO MOORING SYSTEM - DERRICK HOIST & MACHIN

NUMBER	COMPUTER	CHECKED BY	DATE
V.O. 56017	WAP		5-4-'65

AIR VS HYDRAULIC S

AIR

IR #K6U

HOIST FINISH — DEMETCOAT SPEC ORDER

OTHER UNITS TO POWER — NONE

CONTROL CAB NOT REQD

COST — (PRIME MOVER & POWER UNIT)
(HOIST) } 18,791.00 fob V.O.
(HYDRAULIC FLUID) — NONE

T & MACHINERY

AULIC SYSTEM (Contd)

	HYDRAULIC	
6U	MARCO # W0960	GEARMATIC 22S
AT SPEC ORDER	GALV. W/ S.S. FASTNERS	DEMETCOAT SPEC ORDER
YE	POSSIBLE AIR COMPRESSOR	POSSIBLE AIR COMPRESSOR
CONTROL CABO NOT REQD	9,354.00 LOSS CONTROL CABINET	
1.00 fob V.O.	6454.00 fob OHIO 2900.00 fob SEATTLE 75.00/100 GAL	14,791.00 INC CONTROL CABINET 75.00/100 GAL

COMPUTATION SHEET
ENGINEERING DEPARTMENT
McD 5011

J. RAY McDERMOTT & Co., INC.

COMPANY	FIELD	SHEET NO.
U.S. Army ERDL		1 of
SUBJECT	WELL NO.	DATE
Mono Mooring System -		8/5/65
DRAWING NO.	COMPUTER	
J.O. 56017 - Eng. Load on Bolts @ Launching	WAP	

Conditions: Engine G.M. Type 371 HE Cooled
Dry Wt Approx 1800#
G.G. Base Mounts Approx 19"
Distance Btwn. Mounts 24" Long
Total Bolting 6 - $\frac{1}{2}$"ϕ
Launch Impact Assume 5g

$1800 \times 5 = 9000^{\#}$ Load @ Launch on Bolts

$\text{Shear/Bolt} = \frac{9000}{6} = 1500^{\#}$

$\text{Moment} = 9000 \times 19 = 171{,}000^{"\#}$

$\text{Tension in Bolts} = \frac{171{,}000}{24} = 7120^{\#}$

$\text{Load/Tension/Bolt} = \frac{7120}{3} = 2370^{\#}$

$\frac{1}{2}$" Bolt in Shear Allowable 2.6^{K}

$\frac{1}{2}$" Bolt in Tension Allowable 4^{K}.

NOTE: While bolting is adequate to hold engine on foundation during buoy launching the engine mfg. advises that mounts & frame are of cast iron and advise that lateral bracing from engine lifting bolts to buoy overhead should be installed to relieve load from cast frame work. A fracture in the frame would require rebuilding the engine inside the buoy which could be difficult.

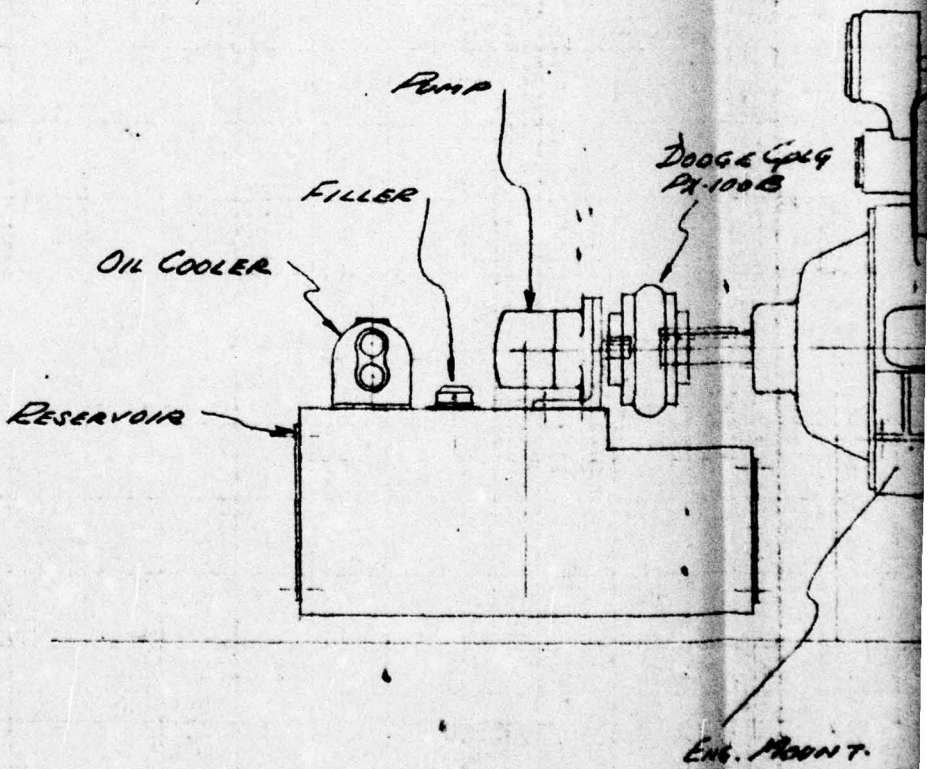
ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 8036

J. RAY McDERMOTT & Co., INC.

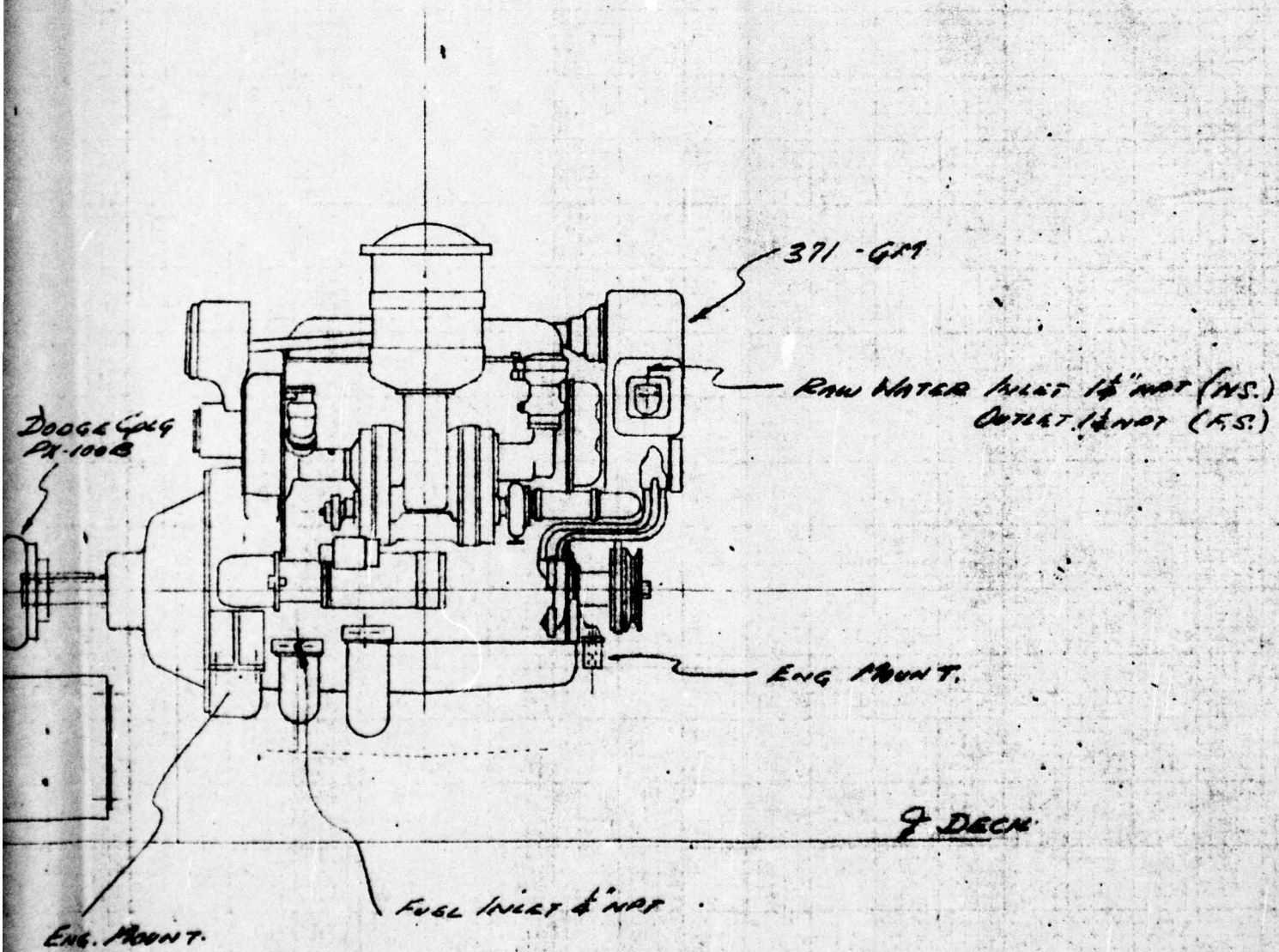
COMPANY	SHEET NO
U.S. Army - ERDL	1 of

SUBJECT: Mono Mooring System - Hydraulic Pumping Unit

[redacted] NUMBER	COMPUTER	CHECKED BY	DATE
J.O. 56017	mgp		6-2-65



NG UNIT



ELEVATION

N.T.S.

2

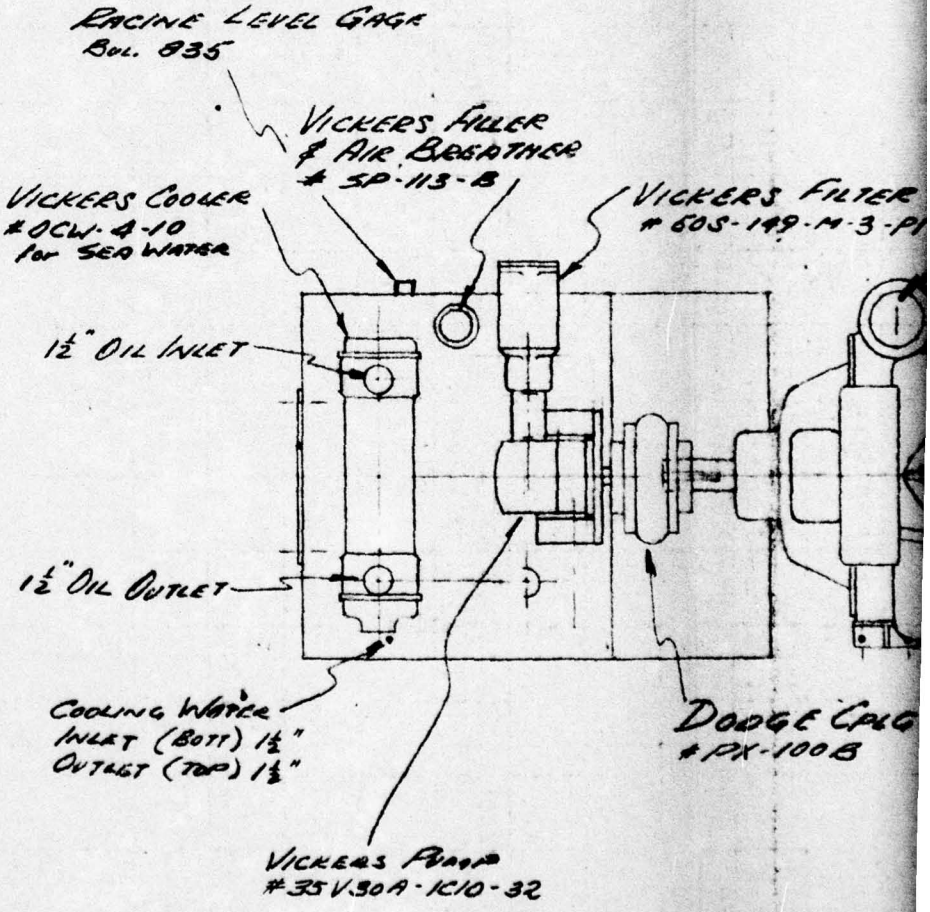
NGINEERING DEPARTMENT
OMPUTATION SHEET
D 5036

J. RAY MCDERMOTT & CO., INC.

COMPANY: U.S. ARMY - ERDL. | SHEET NO. 2 of

SUBJECT: MOORING SYSTEM - HYDRAULIC POWER UNIT

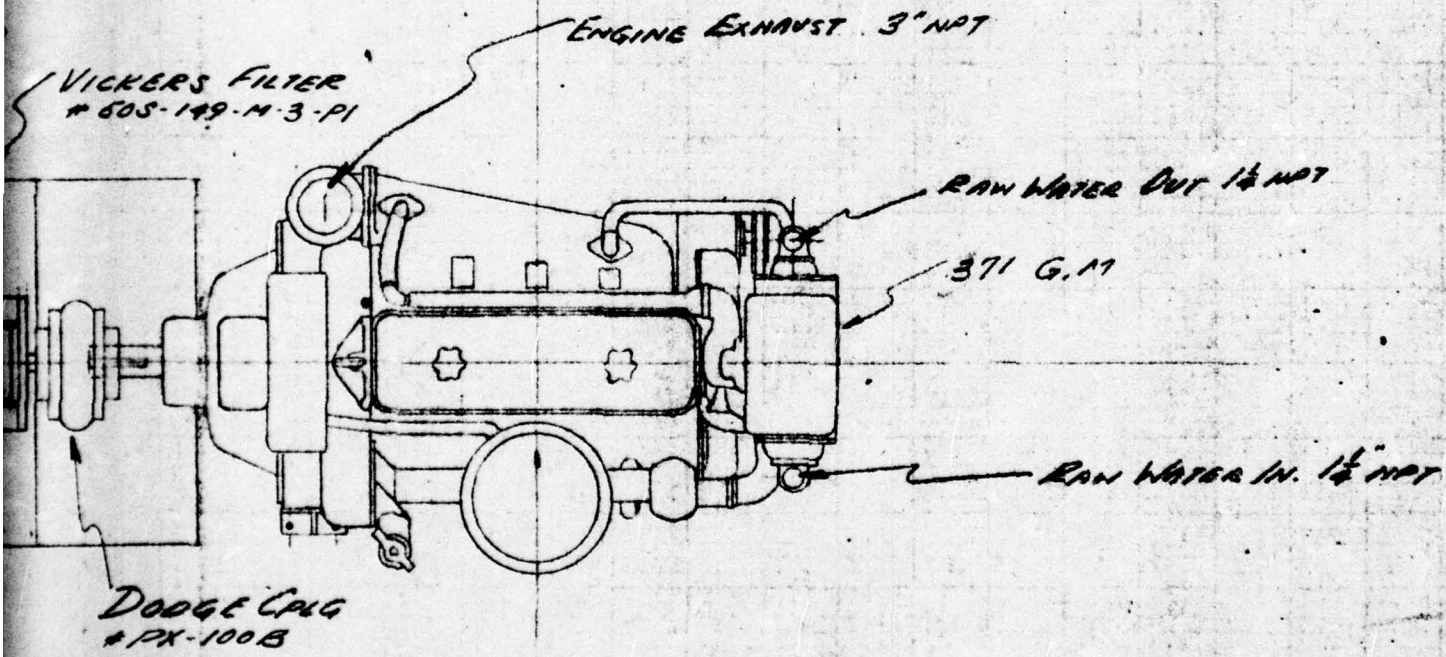
DRAWING NUMBER: J.O. 56017 | COMPUTER: WAP | CHECKED BY: | DATE: 6-3-65



PLA

(N.T.S.)

G UNIT
5



PLAN

N.T.S.

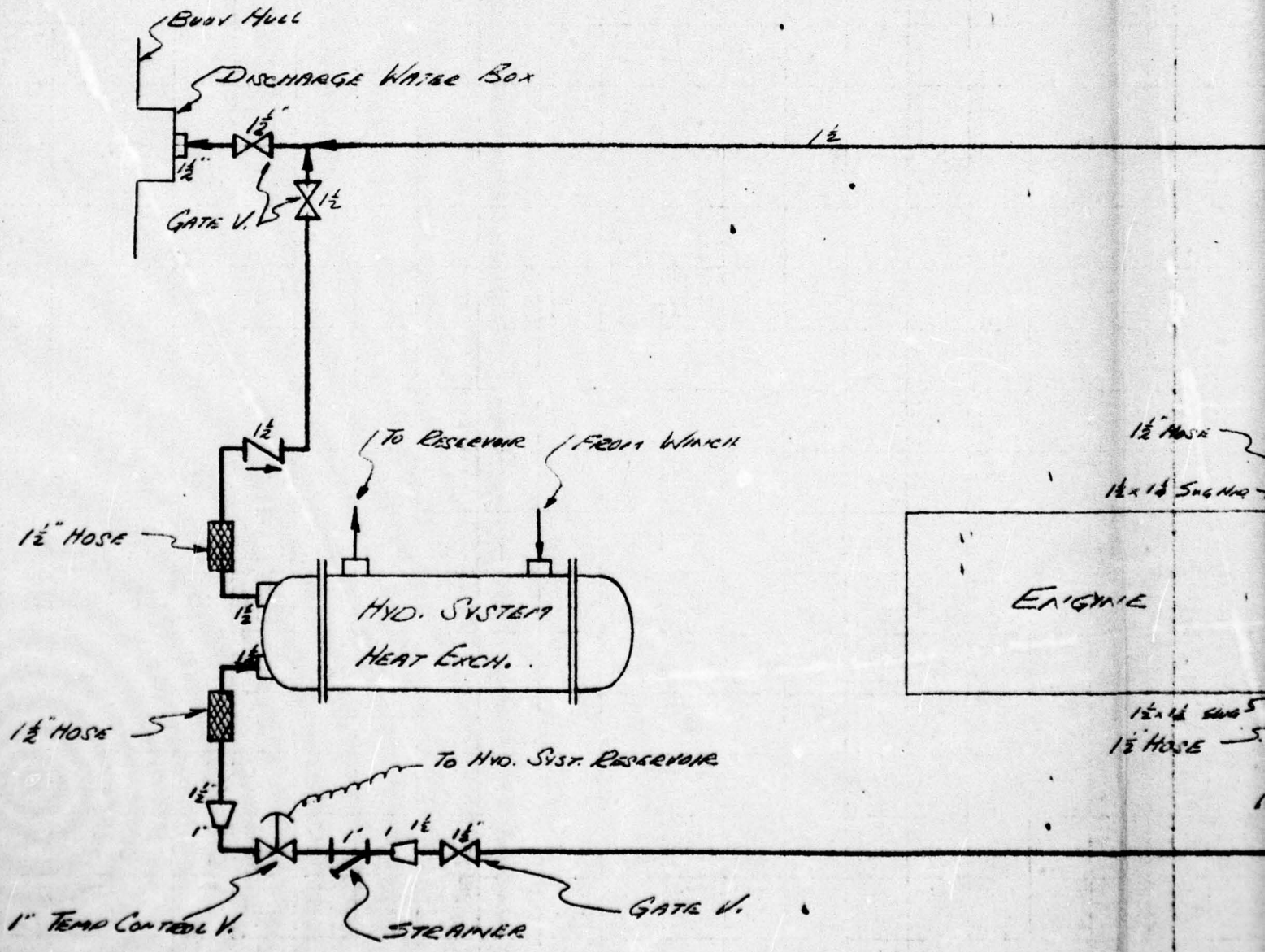
2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 5036

J. RAY McDERMOTT & CO., INC.

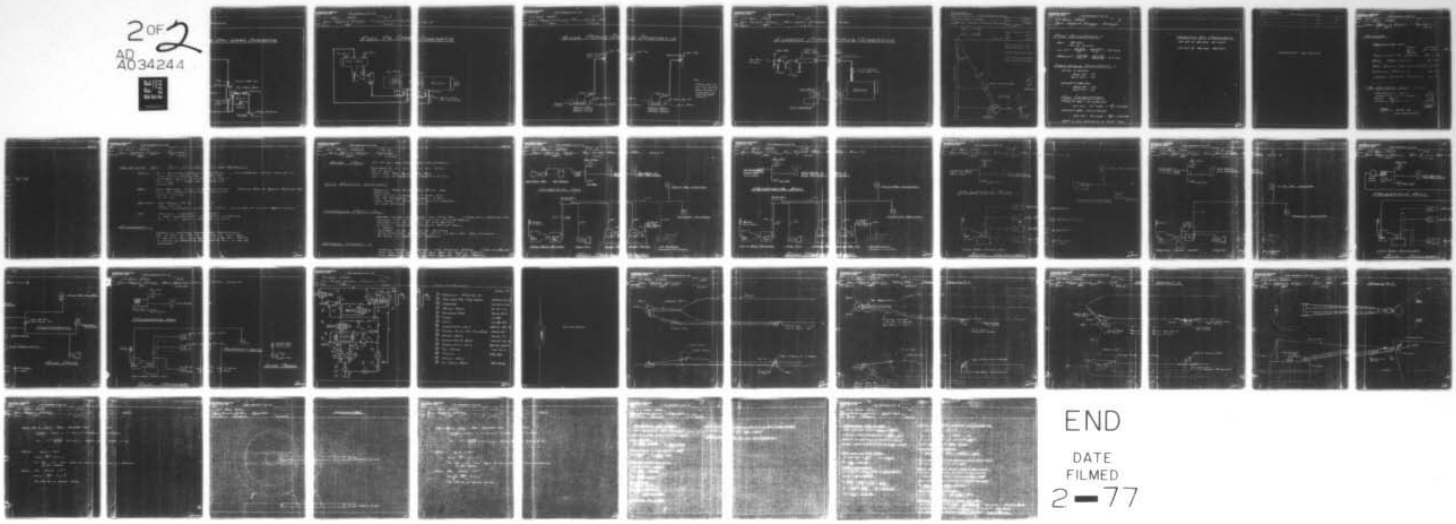
COMPANY	SHEET NO
U.S. ARMY - E.R.D.L	1 of
SUBJECT	
MONO MOORING SYSTEM - PIPING SYSTEMS - COOLING WATER	
DRAWING NUMBER	COMPUTER
JO. 56017	WAP
CHECKED BY	DATE
	7-20-65

HEAT EXCHANGER RA



AD-A034 244 MCDERMOTT (J RAY) CO INC NEW ORLEANS LA F/G 13/10
ENGINEERING DESIGN CALCULATIONS MONO-MOORING SYSTEM. VOLUME 3. --ETC(U)
1966 DA-44-009-AMC-841(T)
UNCLASSIFIED NL

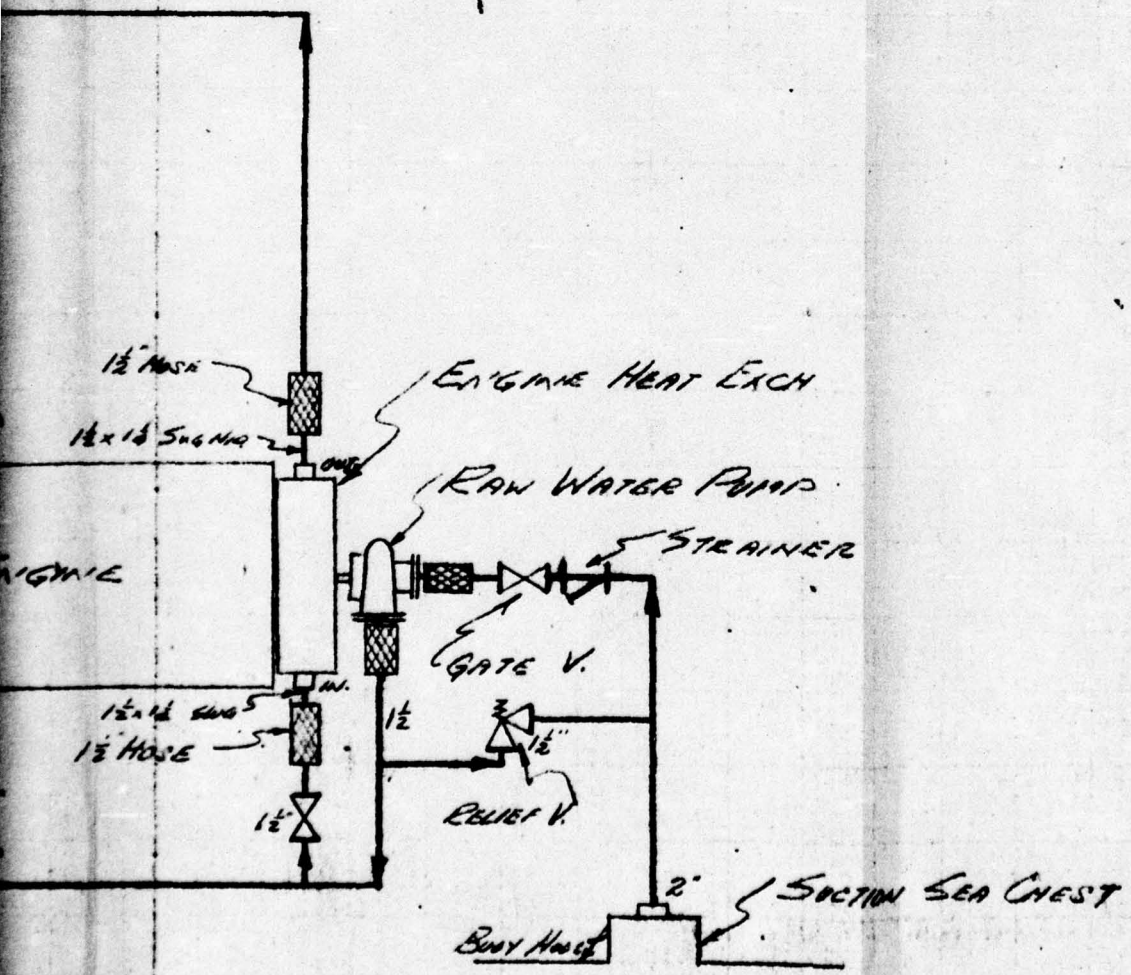
2 OF 2
AD A034244



END
DATE FILMED
2-77

COOLING WATER

RAW WATER SCHEMATIC

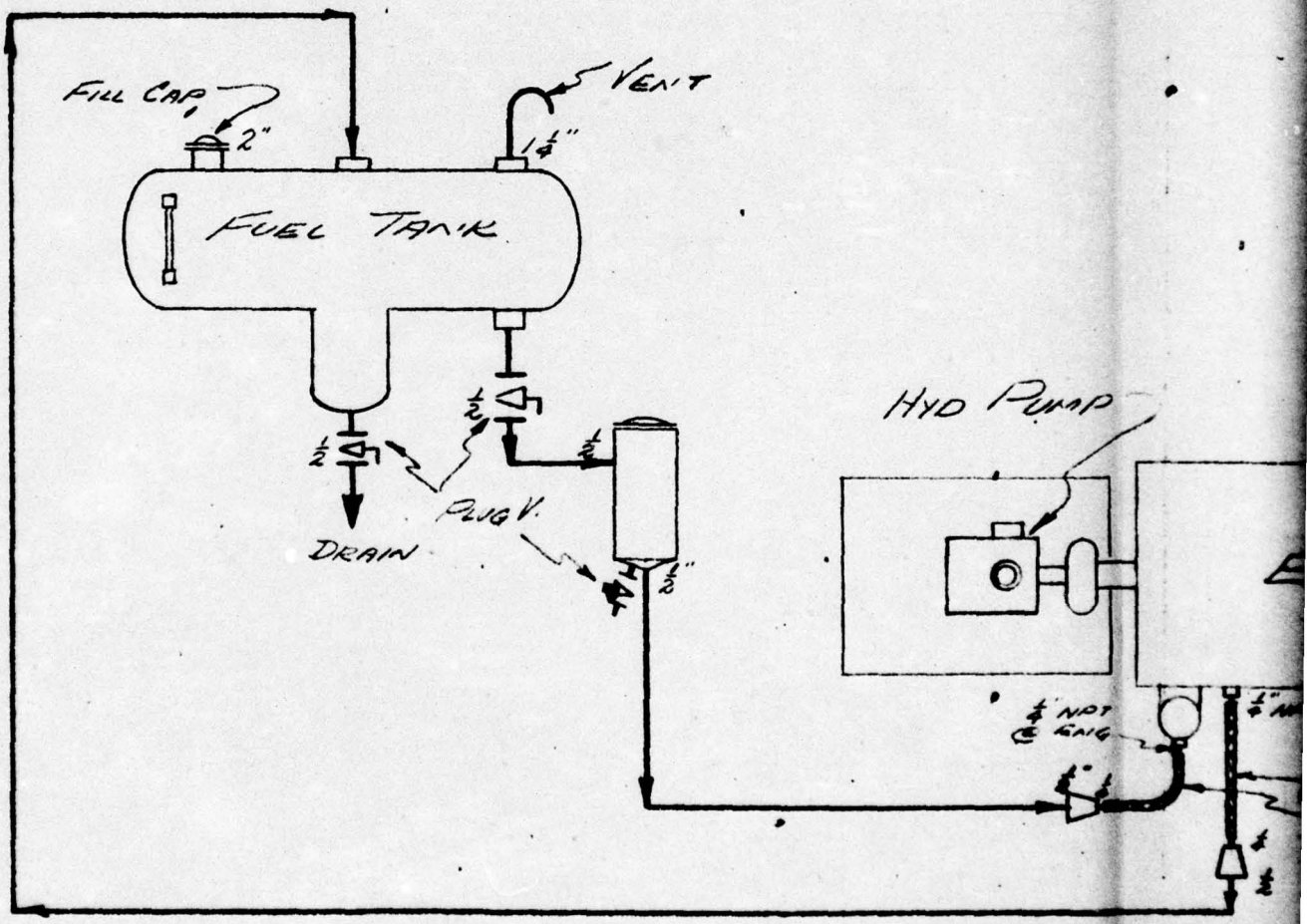


ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 5036

J. RAY McDERMOTT & CO., INC.

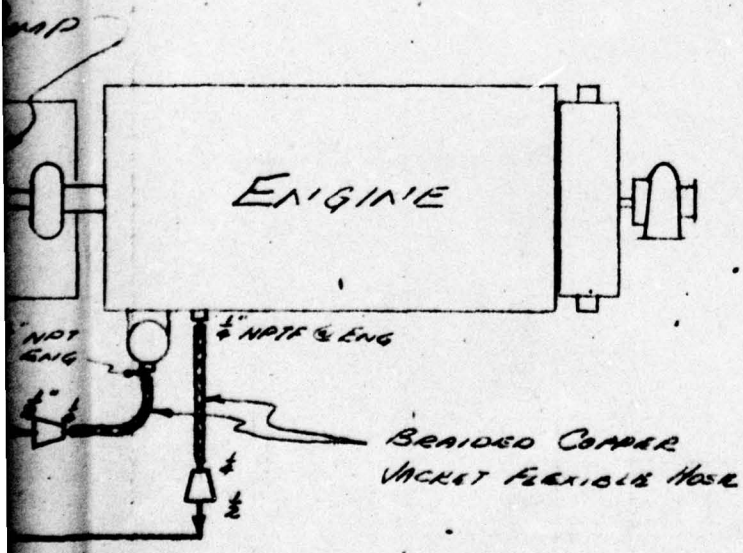
COMPANY: U.S ARMY - ERDL			SHEET NO. 2 of
SUBJECT: MONO MOORING SYSTEM - PIPING SYSTEMS - FUEL OIL			
DRAWING NUMBER: J.O. 56017	COMPUTER: WQP	CHECKED BY:	DATE: 7-20-65

FUEL OIL SCHE



S - FUEL OIL

SCHEMATIC

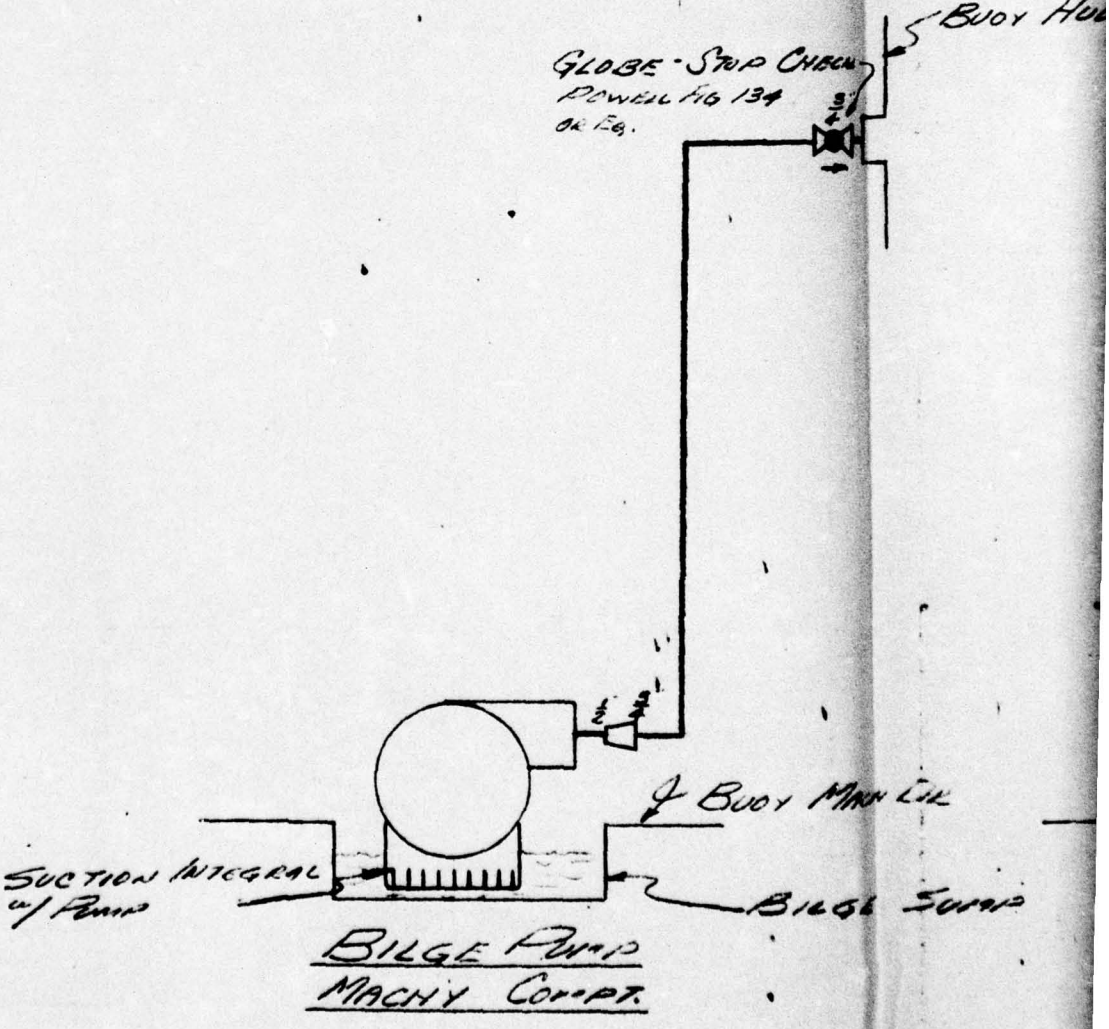


ENGINEERING DEPARTMENT
COMPUTATION SHEET
CD 5036

J. RAY McDERMOTT & Co., INC.

COMPANY: U.S. ARMY - ERDL			SHEET NO: 3 of
SUBJECT: MONO MOORING SYSTEM PIPING SYSTEMS - BILGE			
DRAWING NUMBER: V.O. 56017	COMPUTER: WQP	CHECKED BY:	DATE: 7-21-65

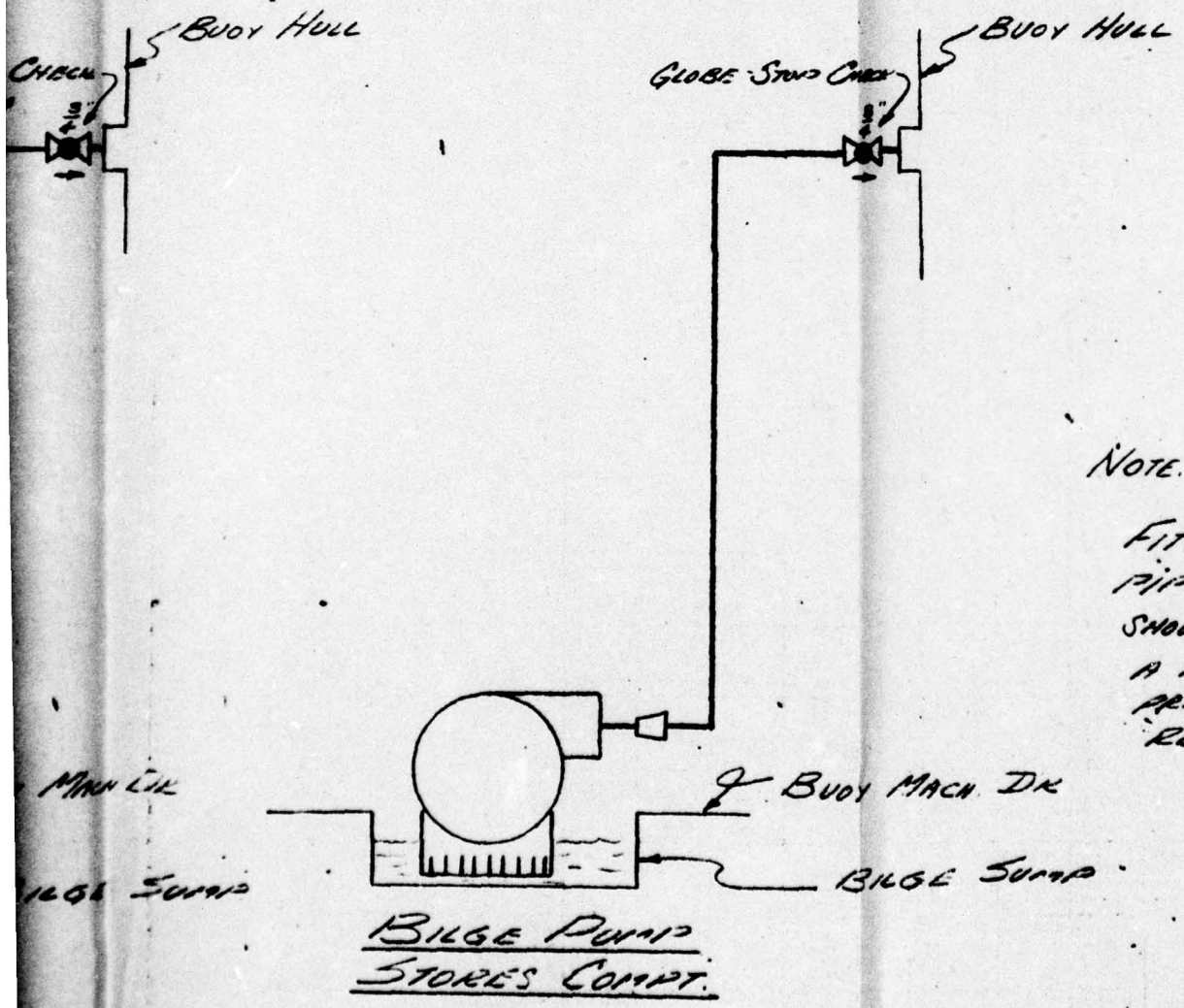
BILGE PIPING SC



BILGE PUMP
MACH'Y COMPT.

BILGE

ING SCHEMATIC



BILGE PUMP
STORES COMPT.

NOTE: -

FITTINGS USED TO PIPE THIS SYSTEM SHOULD BE KEPT TO A MINIMUM FOR PRESSURE DROP REASONS.

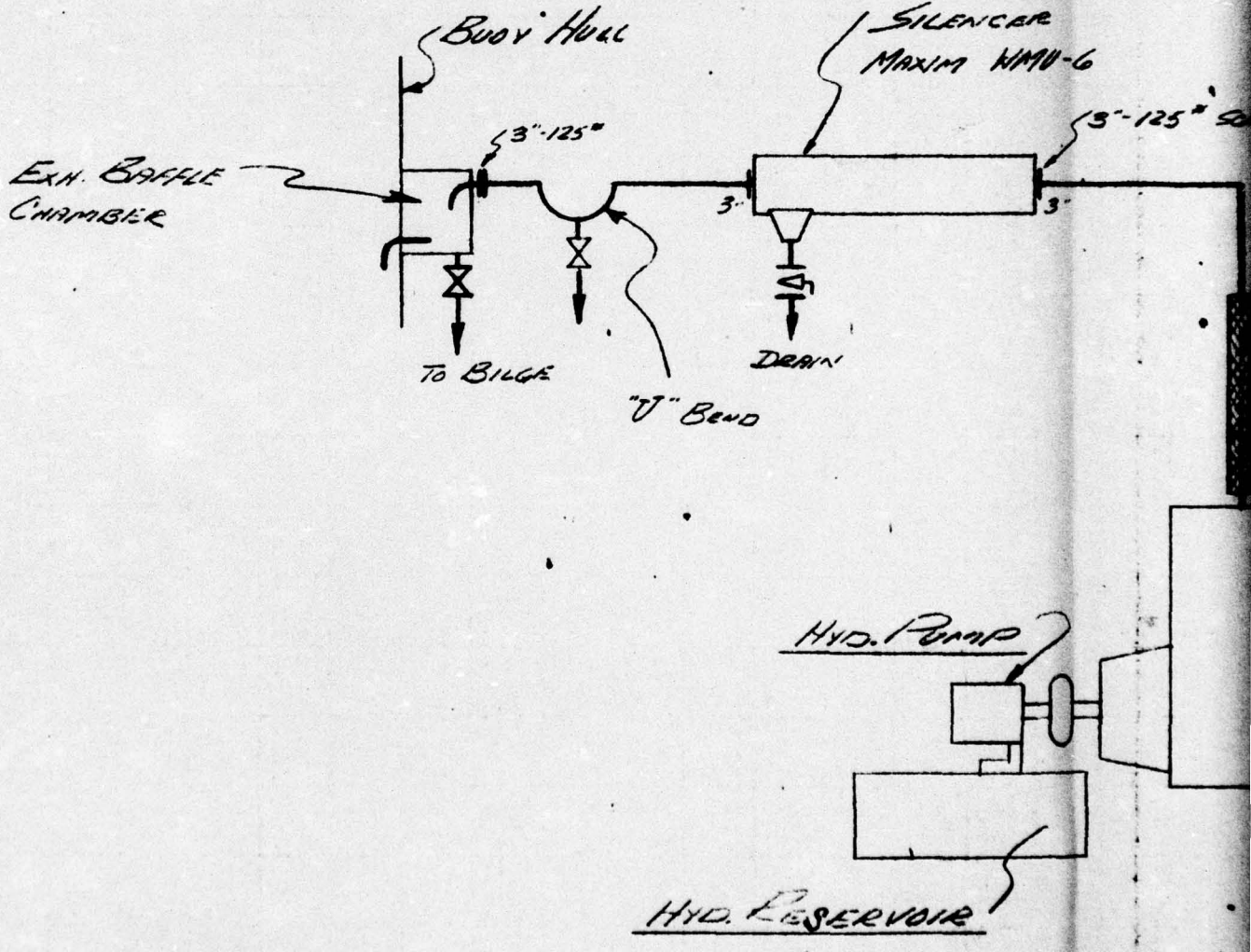
2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 5036

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO.
U.S. ARMY - ERDL	47
SUBJECT	
MONO MOORING SYSTEM - PIPING SYSTEMS - ENG. EXHAUST	
DRAWING NUMBER / JO. 56017	COMPUTER WAP
CHECKED BY	DATE 7-21-65

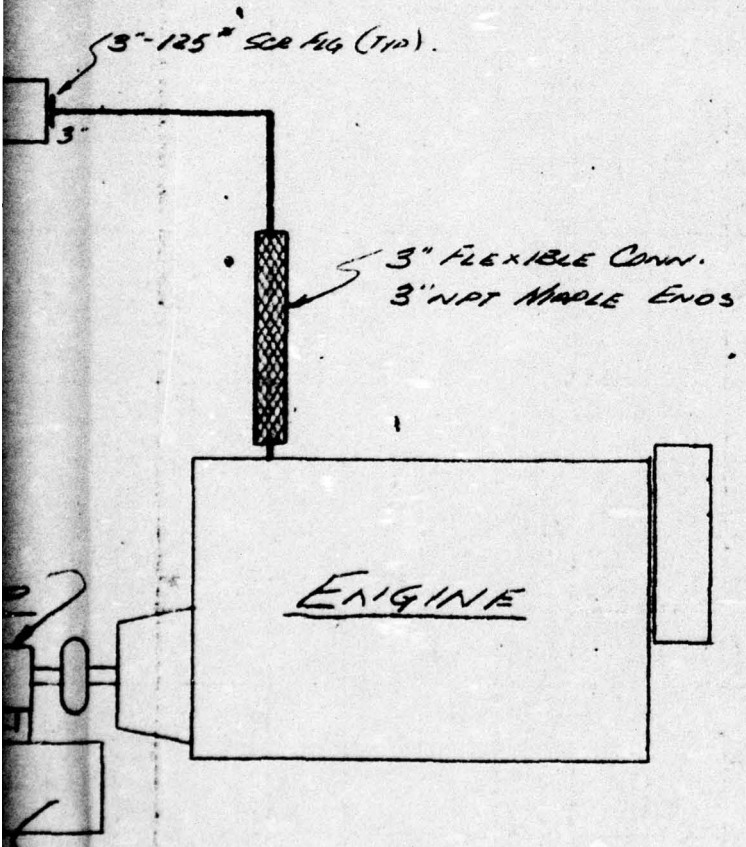
EXHAUST PIPIN



. EXHAUST

PIPING SCHEMATIC

ER
MMU-6



COMPUTATION SHEET
ENGINEERING DEPARTMENT
MCD 5011

J. RAY McDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
U.S. ARMY ERDL		1 of 1
SUBJECT	**WELL NO.**	**DATE**
DIESEL ENGINE EXHAUST LOCATION		11/30/65
DRAWING NO.	**COMPUTER** WAT	

O-X = 5'-6 3/8"

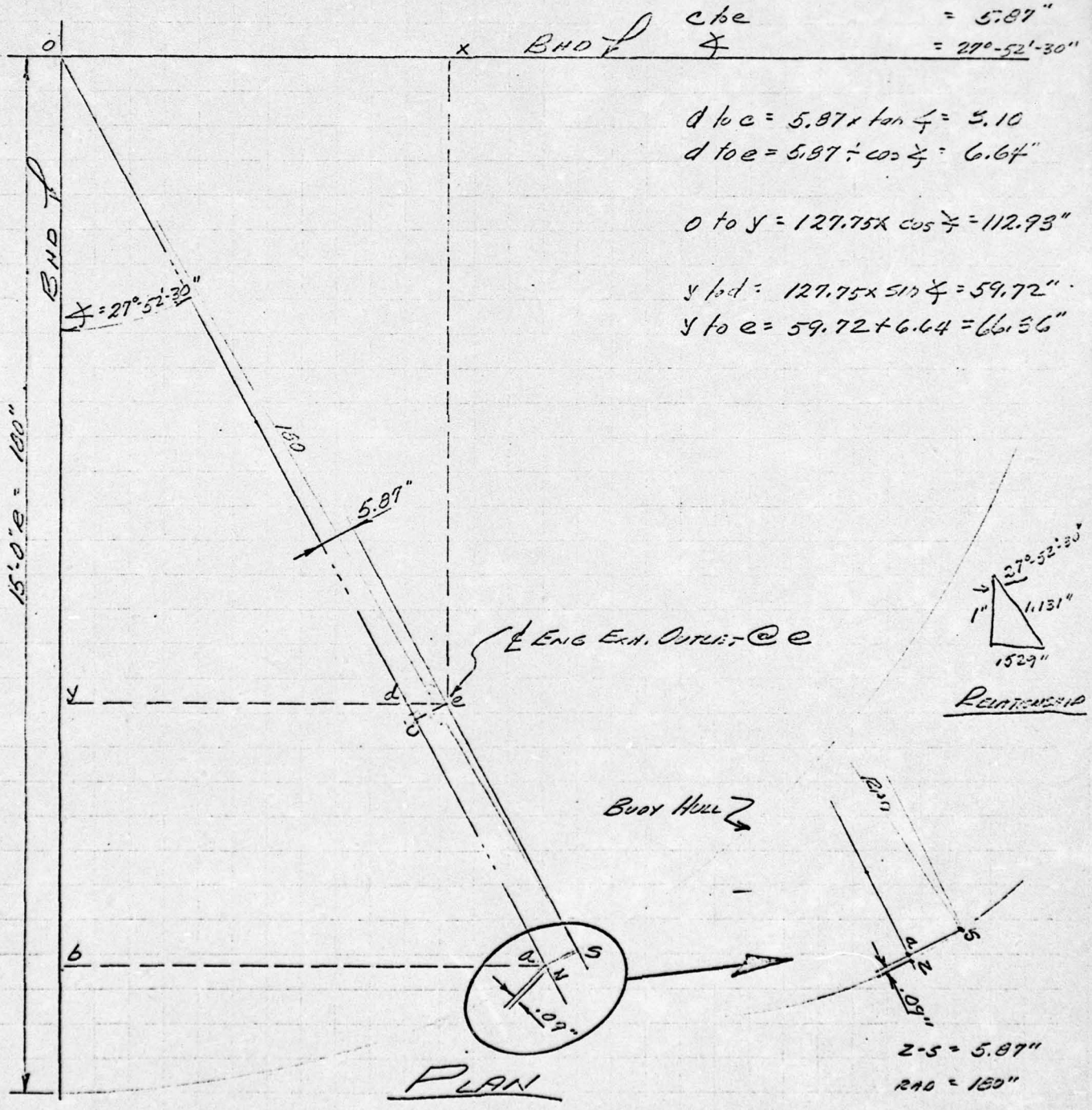
O-Y = 9'-4 15/16"

a b c = 180"-.09" = 179.91"
a b c = 49.06"
c b e = 5.87"
∠ = 27°-52'-30"

d to c = 5.87 x tan ∠ = 5.10
d to e = 5.87 ÷ cos ∠ = 6.64"

O to y = 127.75 x cos ∠ = 112.93"

y to d = 127.75 x sin ∠ = 59.72"
y to e = 59.72 + 6.64 = 66.36"



Z-S = 5.87"
RAD = 180"

PLAN

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 5036

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S ARMY - ERDL	4

SUBJECT: MONO MOORING SYSTEM - HYDRAULIC

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE

PUMP CALCULATIONS :-

REQD - 38 GPM
1500 PSI @ WINCH

$$\text{HYD. H.P} = \frac{\text{GPM (HP)}}{1714} = \frac{38 \times 1500}{1714} = 33.3 \text{ HP}$$

$$\text{BRAKE H.P} = \frac{\text{GPM (Hp)}}{1714 \times E} = \frac{38 \times 1500}{1714 \times .80} = 41.5 \text{ HP}$$

DRIVE ENGINE CALCULATIONS :-

371 GM @ 1800 RPM

RATED H.P = 97
CONT'S H.P = 75

471 GM @ 1800 RPM

RATED HP = 133
CONT'S H.P = 101

FUEL CONSUMPTION

371 G.M. @ 1800 = .46 LBS/BHP/HR

$.46 \times 41.5 = 19.1$ LBS/HR $= \frac{19.1}{7} = 2.73$ GPH.

471 G.M. @ 1800 = .447 LBS/BHP/HR

$.447 \times 41.5 = 18.6$ LBS/HR $= \frac{18.6}{7} = 2.66$ GPH

BHP OF ENG 14% LOWER ON "CITE" FUEL

COMBUSTION AIR REQUIREMENTS

371 GM @ 1800 RPM 319 SCFM

471 G.M @ 1800 RPM 425 SCFM

COMPUTATION SHEET
ENGINEERING DEPARTMENT
CD 5011

J. RAY MCDERMOTT & CO., INC.

COMPANY	FIELD	SHEET NO.
UBJECT	WELL NO.	DATE
ING NO.	COMPUTER	

MACHINERY AND POWER

ENGINEERING DEPARTMENT
COMPUTATION SHEET
NED 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY - ERDL	

SUBJECT: MONO MOORING SYSTEM - MACHINERY

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	WAP		1-26-65

MACHINERY:

NAVIGATIONAL AIDS

LIGHTS	10 WATTS
HORN	320 WATTS (BLOW OFF)
BEACON	
ILLUMINATION FOR WORKING	2000 WATTS
BILGE PUMP (100 GPM)	1½ HP
DECK ROTATING MACHINERY (HYDRAULIC)	(2 HP)
HYDRAULIC PUMPING SET	22 HP
DERRICK WINDLASS (HYDRAULIC)	(20 HP)

MAX ELECTRICAL LOAD: (WATTS)

NAVIGATIONAL AIDS	330
ILLUMINATION FOR WORKING	2000
BILGE PUMP	1119
HYDRAULIC PUMPING SET	16512
	19,961

$\frac{19,961}{1,000} = 19.9$ KW

(RADIO BEACON NOT INCL.)

TTS

TTS (BLOW 2 SEC
OFF 18 SEC).

WATTS

HP

HP)

HP

HP)

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY - EROL	
SUBJECT	
MONO MOORING SYSTEM - MACHINERY	
DRAWING NUMBER	COMPUTER WJP	CHECKED BY	DATE 1-26-65

NAVIGATIONAL AIDS: - (ALL TO U.S. COAST GUARD

LIGHTS: - 200 mm BUOY & STRUCTURE LANTERN
MULTI-LAMP & CHANGER TYPE
WATERTIGHT, GASKETED CONSTRUCTION
360° VISIBILITY - CLEAR LENS
12 VOLT DC

HORN: - OMNI-DIRECTIONAL - 2 MILE RANGE
WATER TIGHT GASKETED CONSTRUCTION
BATTERY OPERATED
12 VOLT DC

BATTERIES: - DRY PRIMARY TYPE OR
LEAD ACID TYPE
NI. CAD - CHARGING RATE TYPE (ALT

MISC: - NECESSARY ACCESSORIES
TO MEET REQUIREMENTS FOR
AIDS AS SET FORTH IN SPEC

ILLUMINATION: -

LIGHTING IN MACHINERY COMPA
AND ON DECK OR BOOM TO
TO BE DONE AT NIGHT FOR
A VESSEL & MAINTAINING SU
REQUIRED

COAST GUARD REQUIREMENTS)

...RE LANTERN (WALLACE & TIERMAN, TIDELANDS SPECIALTIES, ETC)
...GER TYPE
...D CONSTRUCTION
CLEAR LENS

...MILE RANGE (AUTOMATIC POWER INC, TIDELANDS SPECIALTIES, ETC)
CONSTRUCTION

OR

...TE TYPE (ALT) REQUIRE DEFINATE VENTILATION AGAINST EXPLOSION

...SORIES
...ENTS FOR OPERATING
...TH IN SPECS

...ERY COMPARTMENTS
BUOY TO ALLOW WORK
...WIGHT FOR BOTH MOORING
...TAINING BUOY AS MAY BE

ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO.
U.S. ARMY - E.R.D.L.	3 of

SUBJECT			
MONO MOORING SYSTEM - MACHINERY			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	WAP		1-26-65

BILGE PUMP: (TO U.S. COAST GUARD REQU

CENTRIFUGAL TYPE WITH SELF
MIN 2" SUCTION
1½ HP ELEC. MOTOR DRIVE
MIN PUMPING CAP. 100 GPM

DECK ROTATING MACHINERY:-

HYDRAULIC MOTOR DRIVE
REDUCTION.
WHEN NOT USED TO ROTATE
MUST BE DISENGAGED
FREE SWING OF DECK
BY SEA CONDITION.

HYDRAULIC PUMP SET:-

VARIABLE VOLUME, AXIA
COMPLETE WITH ELEC
REQUIREMENTS 18 G
@ 1500 psi, ALLOWABLE
TO 2000 psi
INTERGRAL 60 GAL
MOTOR CHARATISTIC 20
OIL COOLER NOT REQU

DERRICK WINDLASS:-

HYDRAULIC OPERATED
LINE PULL WITH MA
LINE SPEED WITH MA

5

GUARD REQUIREMENTS)

WITH SELF PRIMING

TOR DRIVE
. 100 GPM @ 35' HEAD

TOR DRIVEN GEAR

TO ROTATE DECK
ENGAGED TO ALLOW
OF DECK AS REQUIRED
DITION.

LUME, AXIAL PISTON TYPE (DENISON, VICKERS, RACINE SECO, ETC)
WITH ELECTRIC MOTOR & COUPLING
TS 18 GPM DELIVERY
ALLOWABLE PRESSURE RANGE

60 GAL RESERVOIR
TISTIC 208 V, 3 ϕ 60 CYC A.C. (APPROX 20 HP ALLOWED)
NOT REQUIRED

PERATED WITH AUTOMATIC BRAKING (GEARMATIC, MARCO ETC)
WITH MEAN DRUM CAP. 17,000 LBS (FORWARD)
D WITH MEAN DRUM CAP. 23 fpm (FORWARD)

2

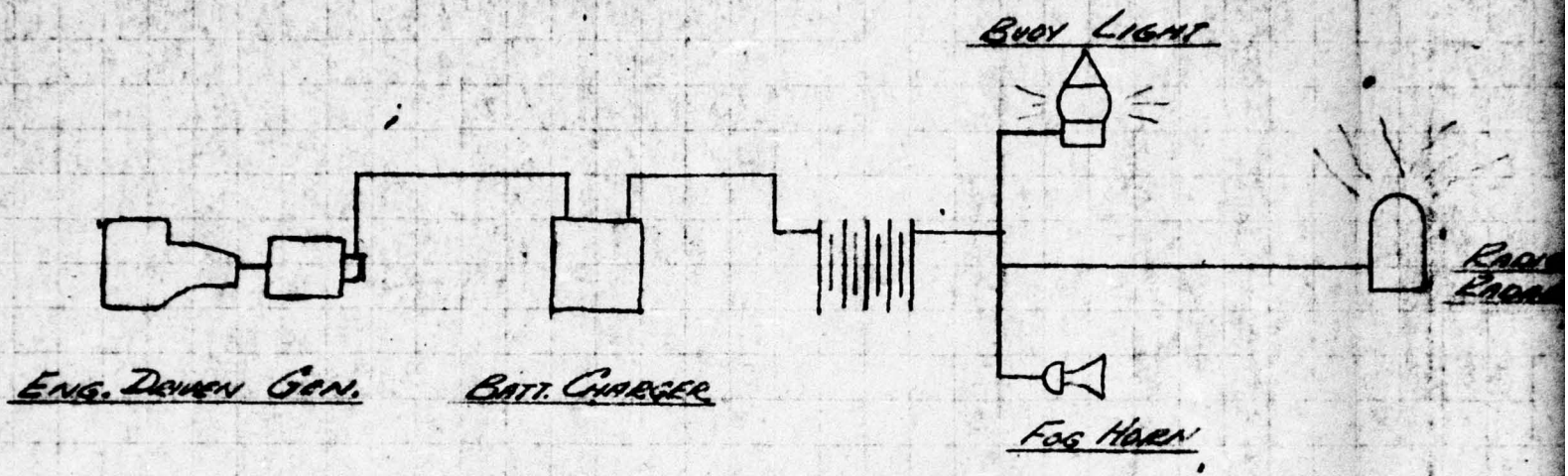
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

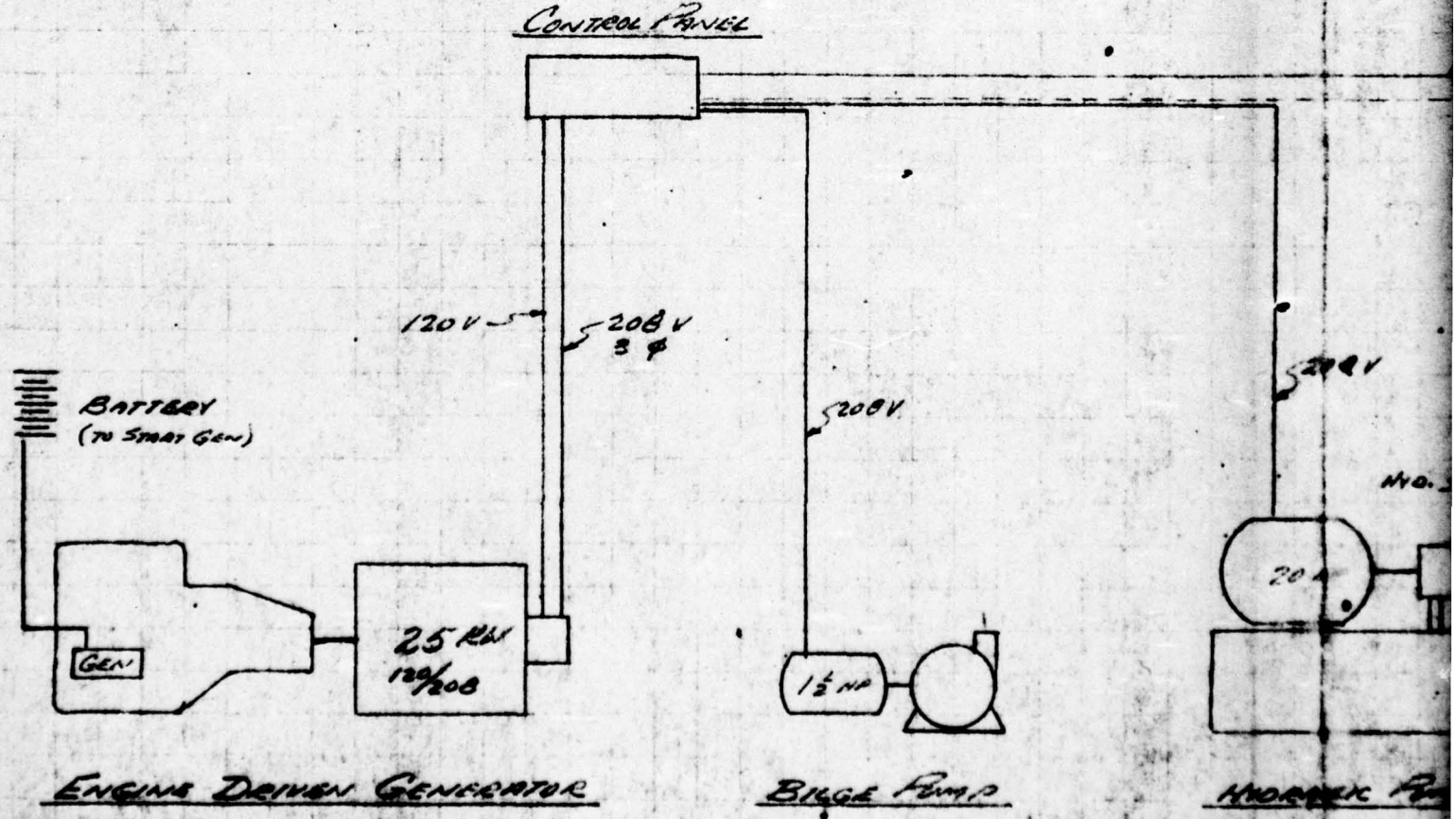
COMPANY: U.S. Army - ERDL | SHEET NO: 4 of

SUBJECT: Mono Mooring System - Basic Machinery Power

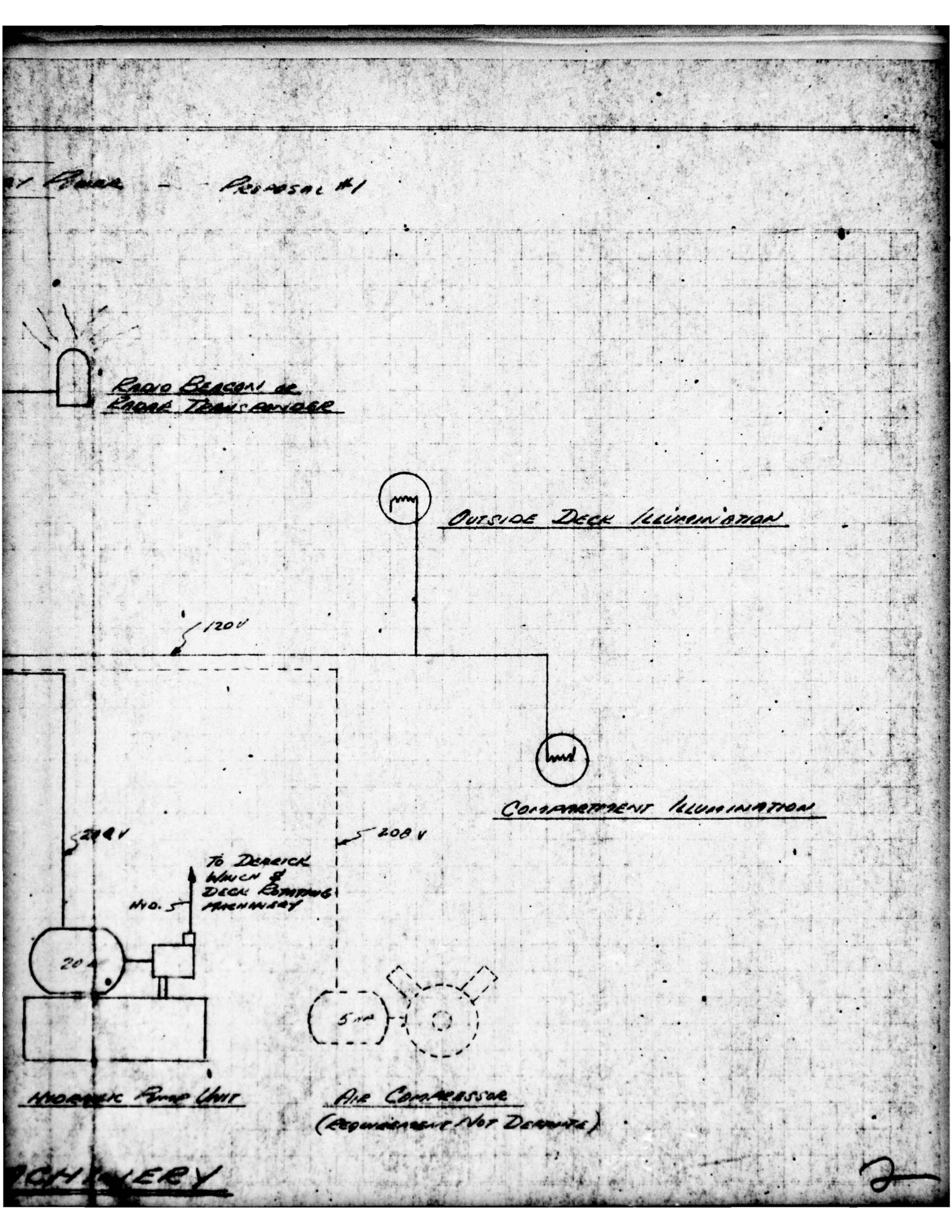
DRAWING NUMBER | COMPUTER: mjp | CHECKED BY | DATE: 1-28-65



Navigational Aids



Buoy Machine



Proposal #1
Radio Beacon or Radar Transponder
Outside Deck Illumination
120V
Compartment Illumination
208 V
To Derrick Winch & Deck Rotating Machinery
Hyd. 5
20
5 HP
Hydraulic Pump Unit
Air Compressor
(Requirement Not Definite)

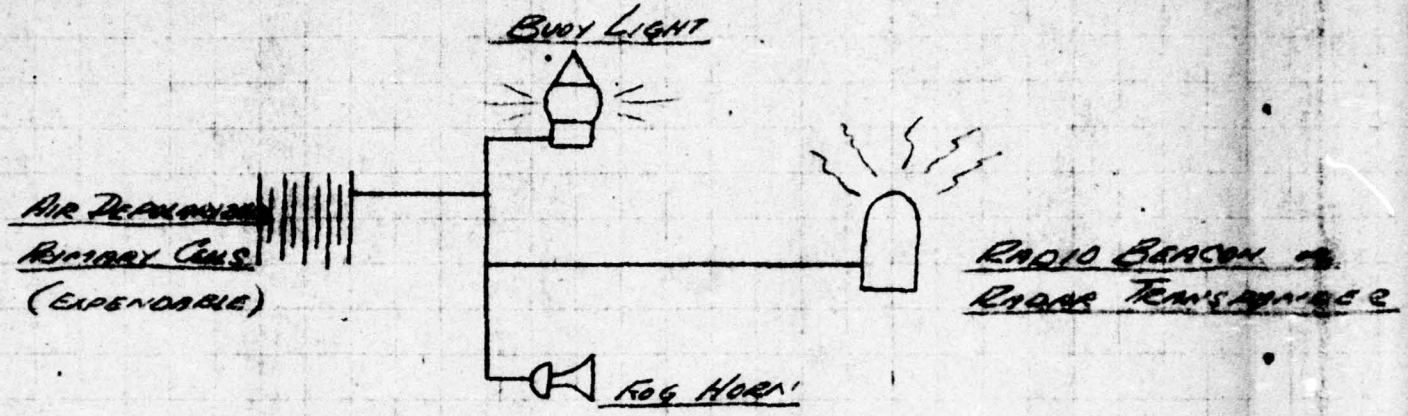
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

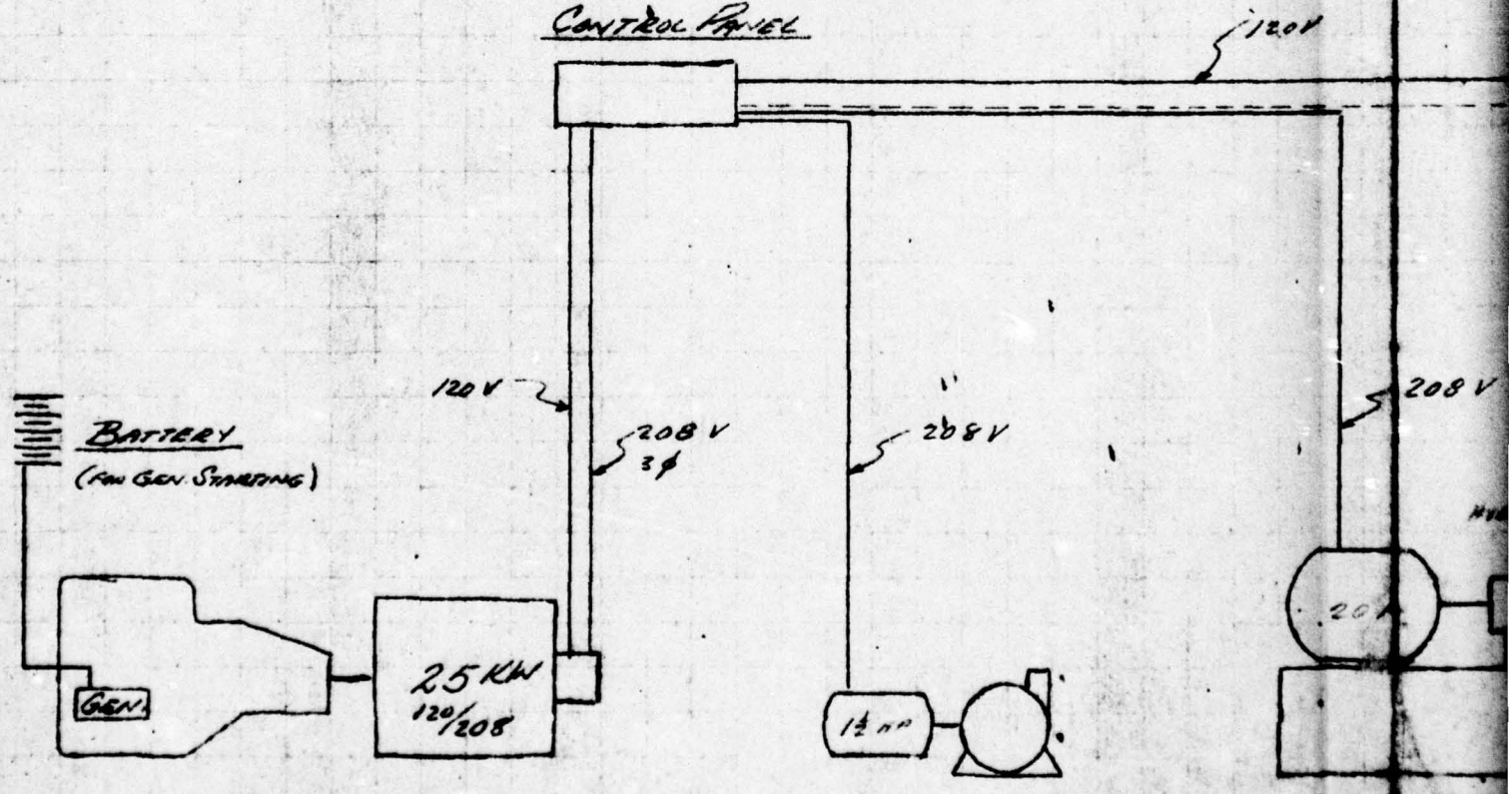
COMPANY	SHEET NO
U.S ARMY - ERDL	5 of

SUBJECT
MONO MOORING SYSTEM - BASIC MACHINERY PANEL - P

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	WAP		1-29-65



NAVIGATIONAL AIDS

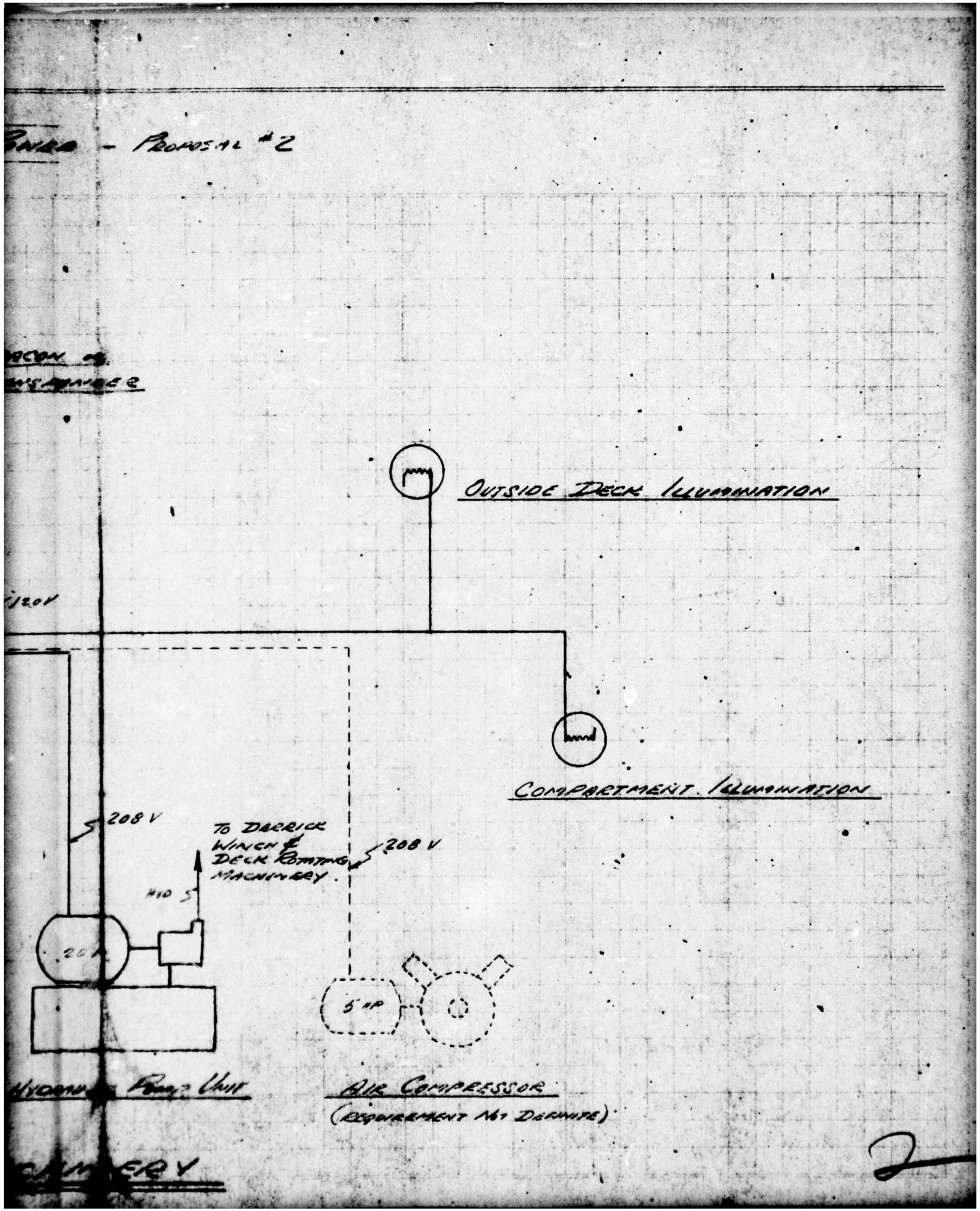


ENGINE DRIVEN GENERATOR

BILGE PUMP

HYDRO

BUOY



- PROPOSAL #2
OUTSIDE DECK ILLUMINATION
120V
COMPARTMENT ILLUMINATION
208 V
TO DERRICK WINCH & DECK ROTATING MACHINERY
208 V
HYD
5 HP
AIR COMPRESSOR
(REQUIREMENT NOT DEFINITE)

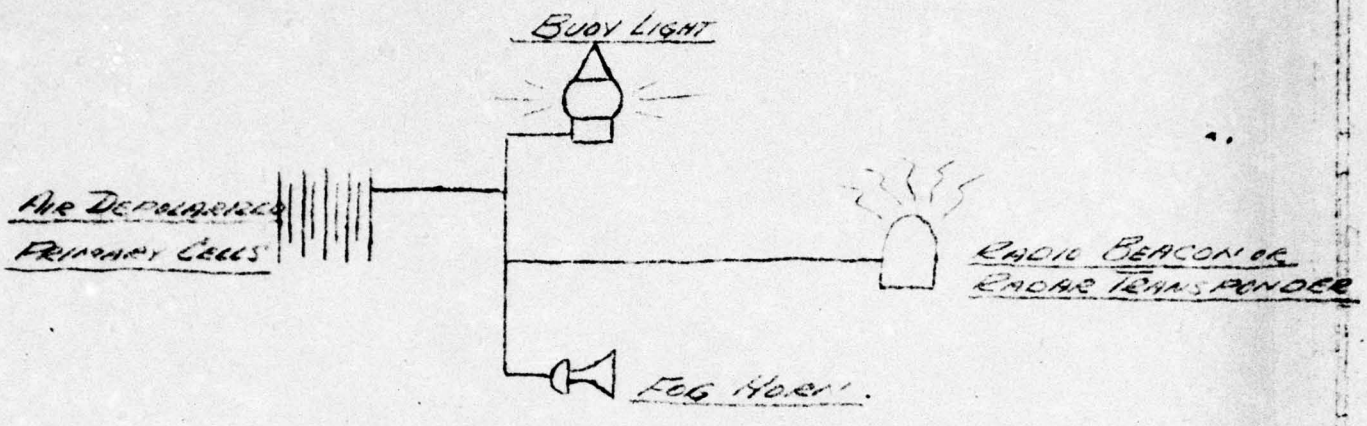
ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

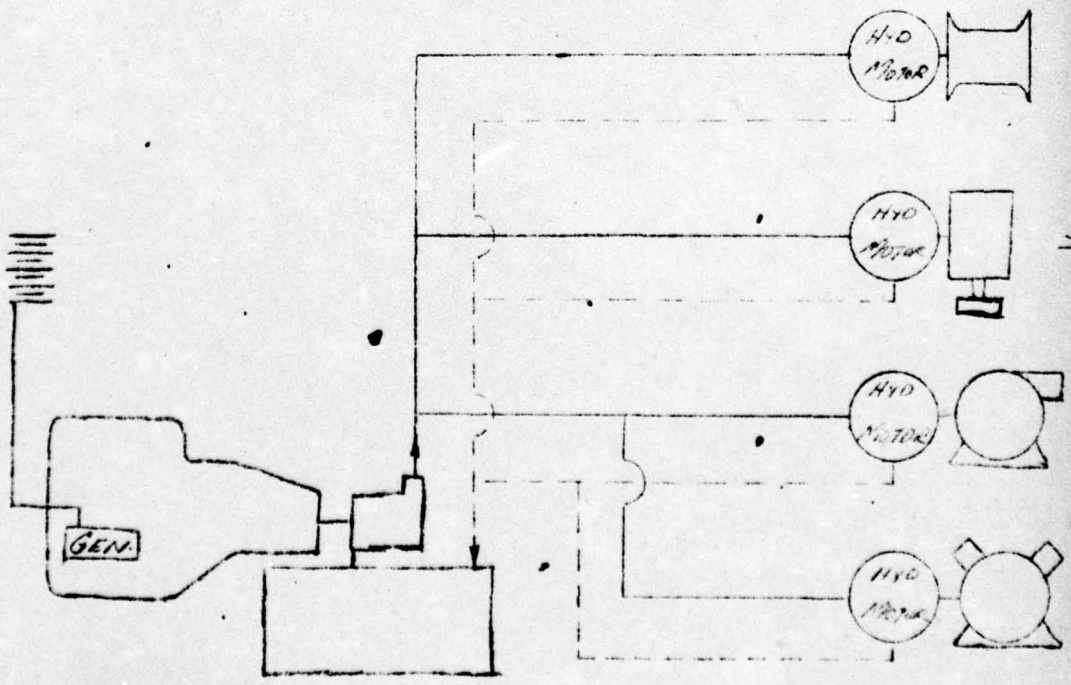
COMPANY: U.S. ARMY - ERDL | SHEET NO: 6 of

SUBJECT: MONO MOORING SYSTEM — BASIC MACHINERY POWER

DRAWING NUMBER | COMPUTER: WHP | CHECKED BY | DATE: 1-29-65



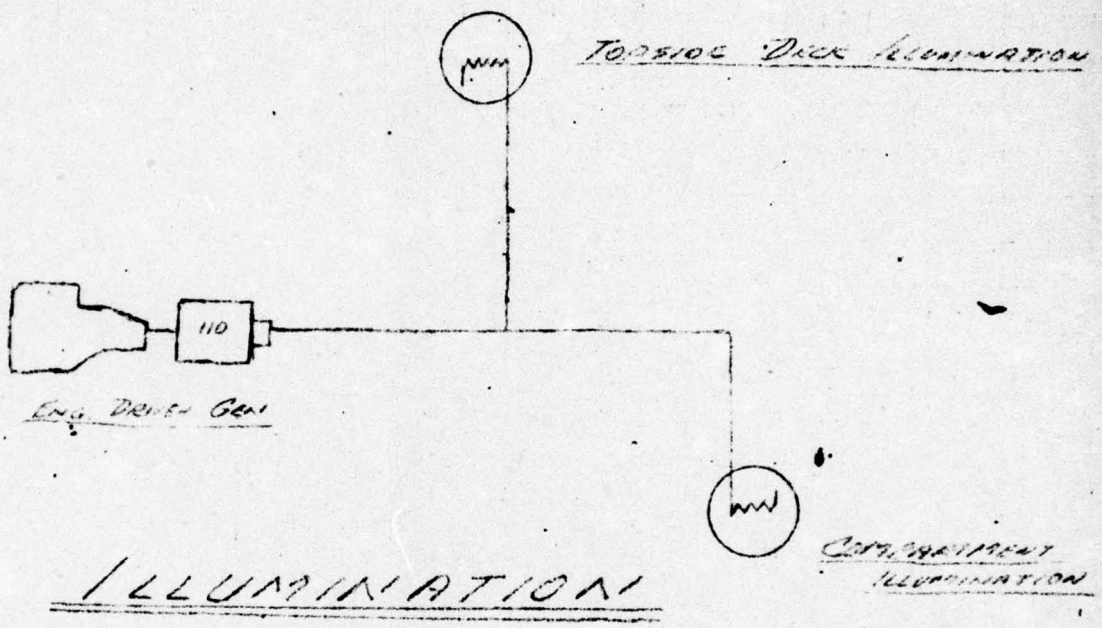
NAVIGATIONAL AIDS



ENGINE DRIVEN HYDRAULIC PUMP

BUOY MACHINERY

POWER - PROPOSAL #3



ILLUMINATION

ON OR
SPONDER

DERRICK WINCH

DECK ROTATING MACHINERY

BILGE PUMP

AIR COMPRESSOR
(IF REQD)

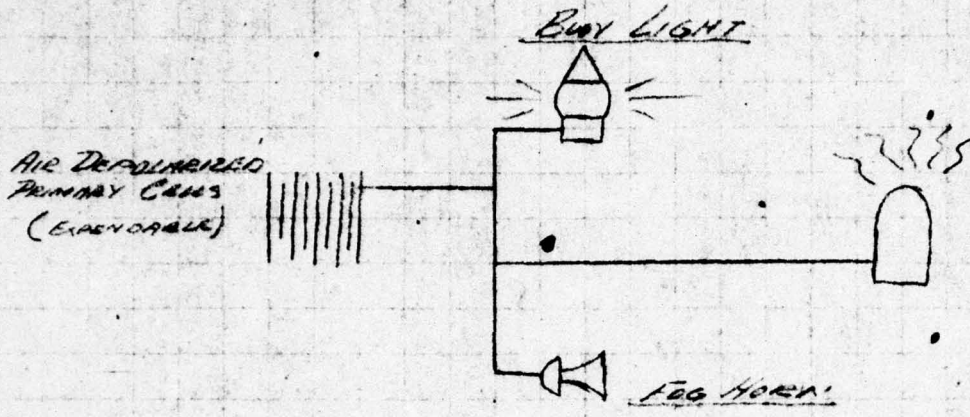
ENGINEERING DEPARTMENT
COMPUTATION SHEET

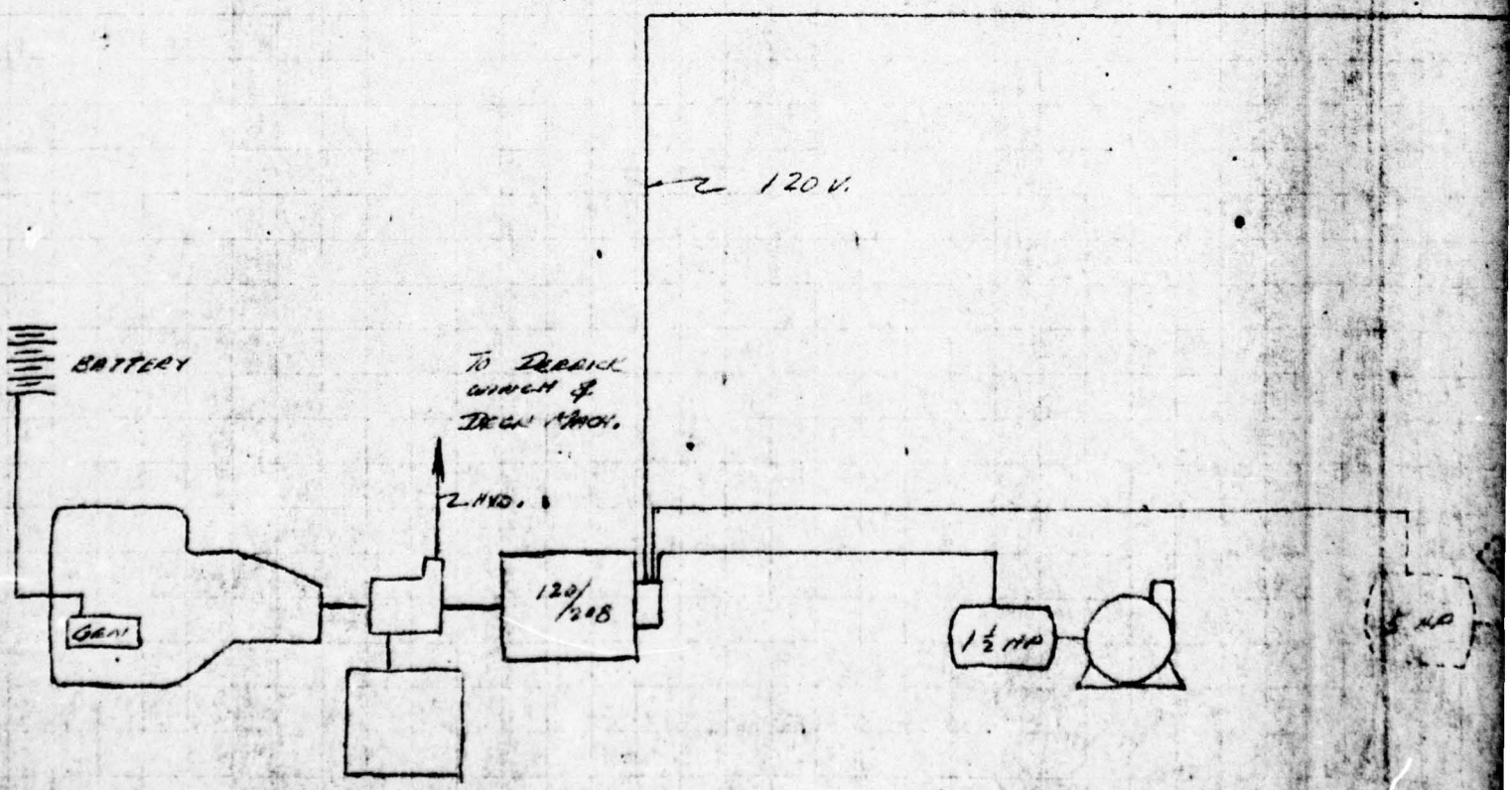
J. RAY McDERMOTT & CO., INC.

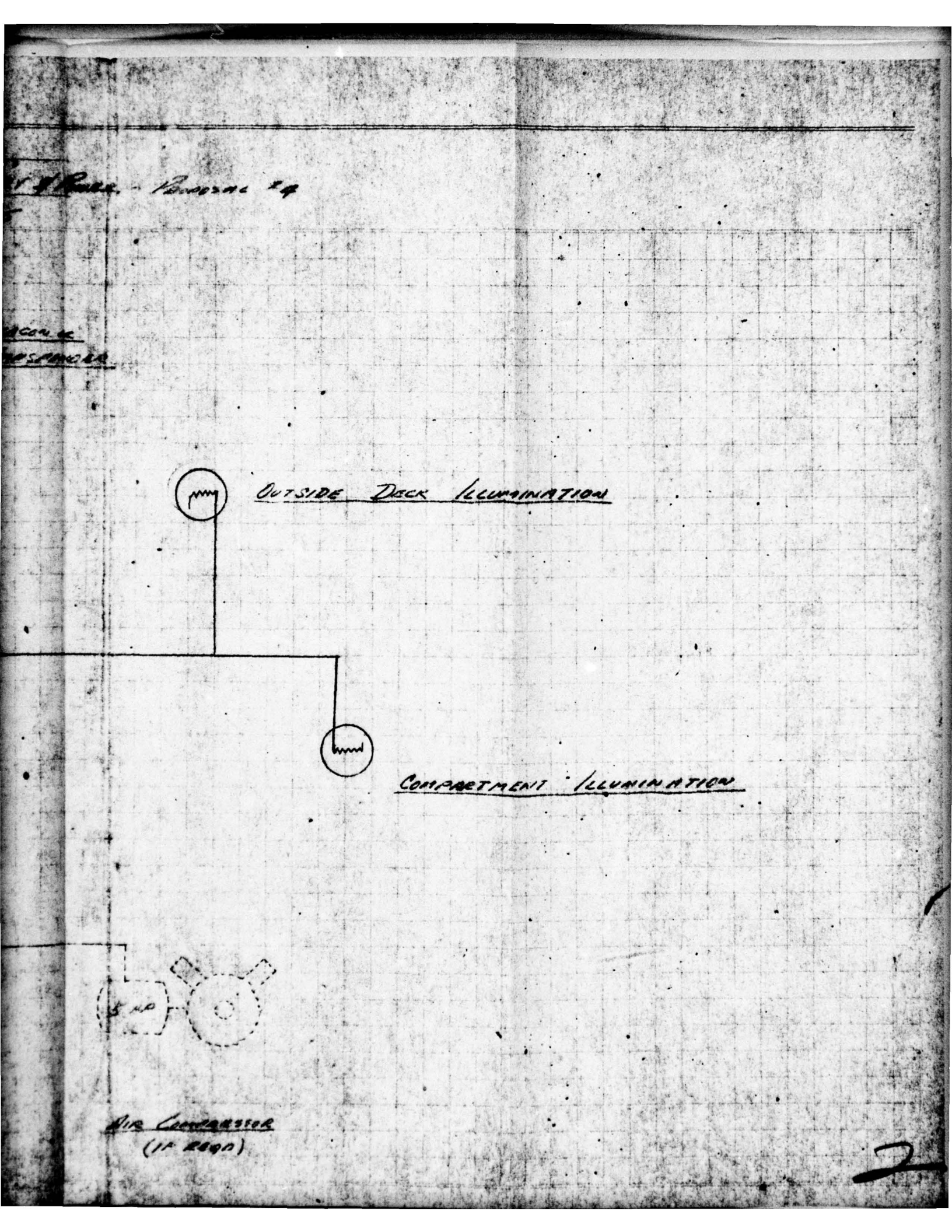
COMPANY: U.S. Army - CERC | SHEET NO: 7 of

SUBJECT: Mono Mooring System - Basic Machinery & Power - [illegible]

DRAWING NUMBER | COMPUTER: WAP | CHECKED BY | DATE: 1-30-65






OUTSIDE DECK ILLUMINATION
COMPARTMENT ILLUMINATION
5 HP
AIR COMPRESSOR
(IF REQD)

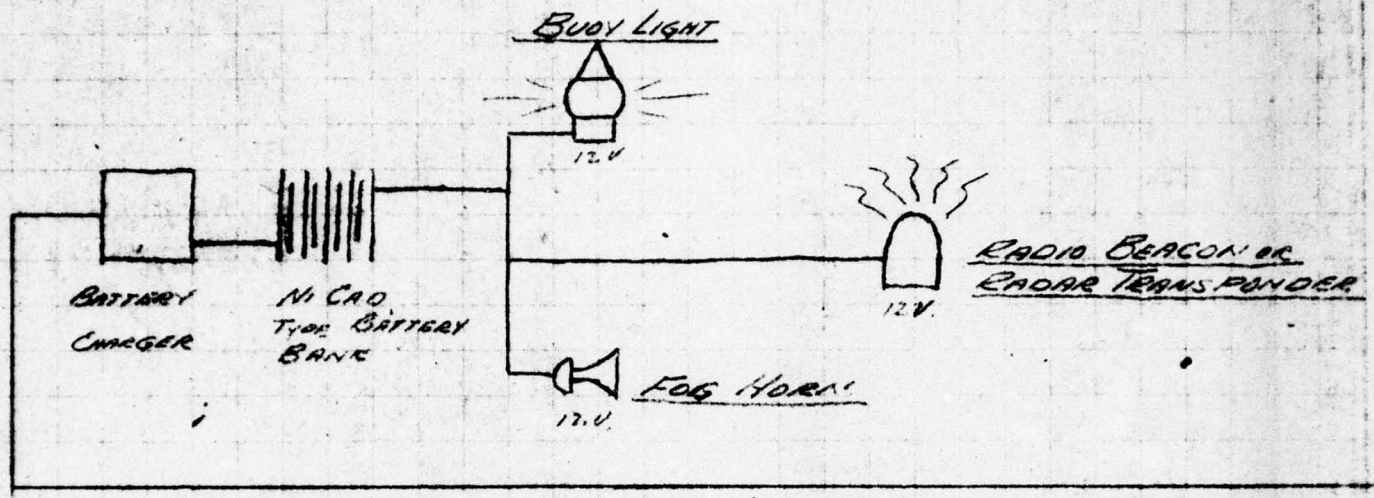
ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

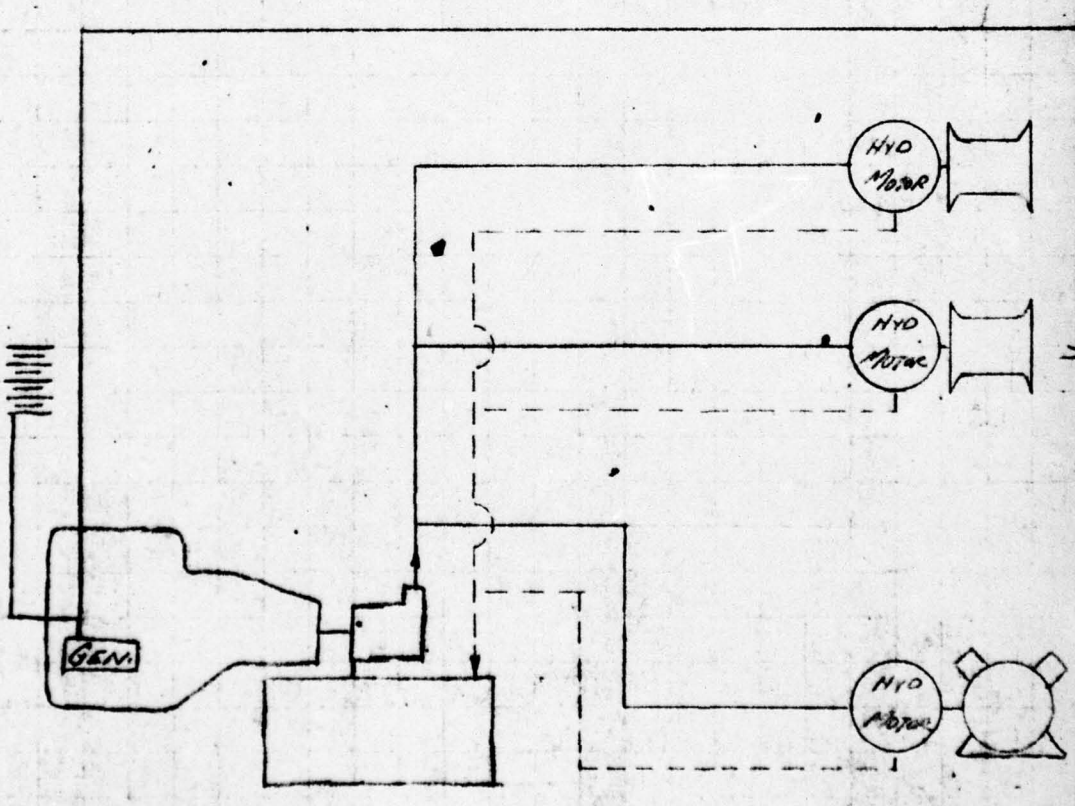
COMPANY	SHEET NO
U.S. ARMY - ERDL	83

SUBJECT: MONO MOORING SYSTEM - BASIC MACHINERY POWER - B...

DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	WAP		3-1-65

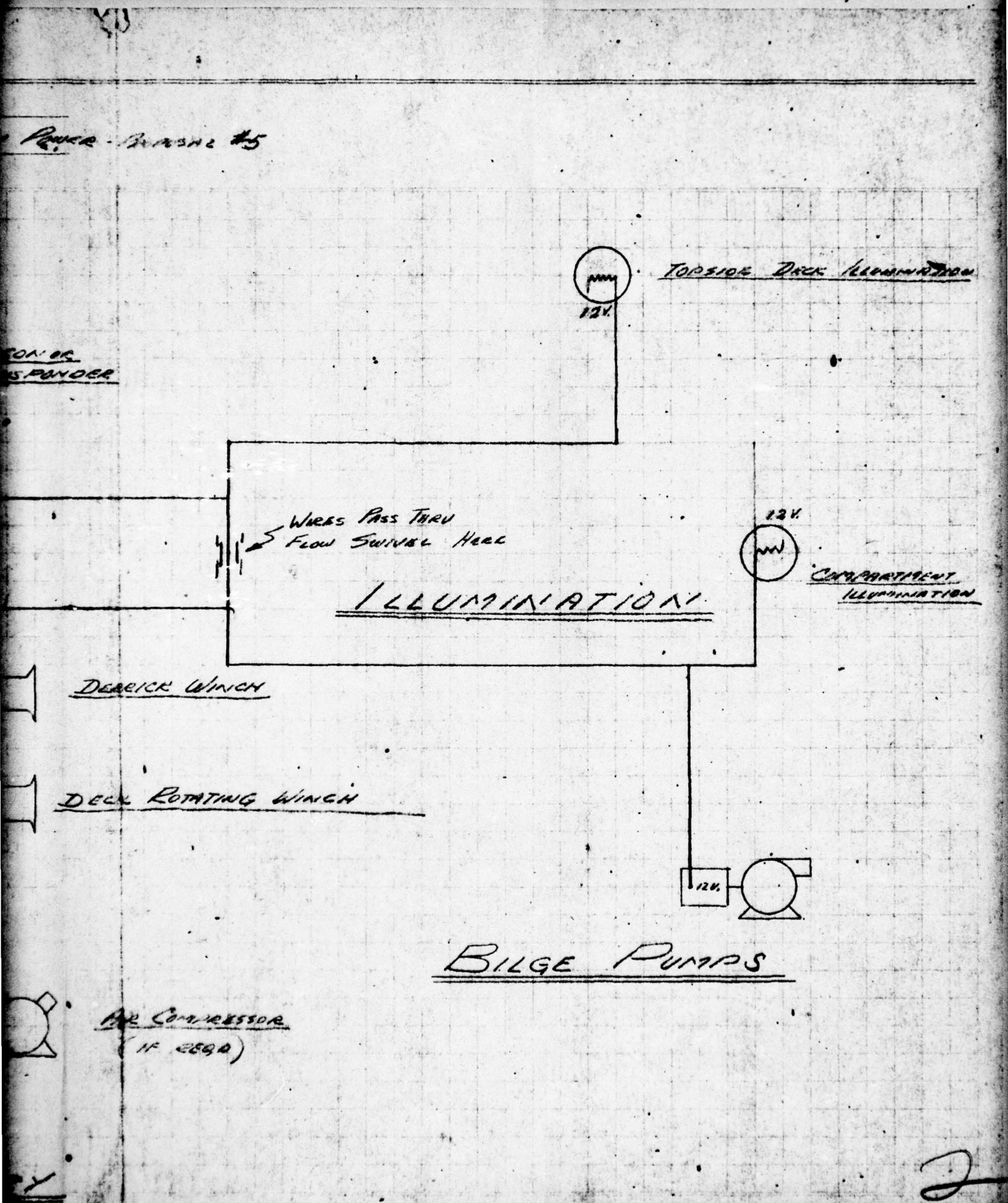


NAVIGATIONAL AIDS



ENGINE DRIVEN HYDRAULIC PUMP

BUOY MACHINERY

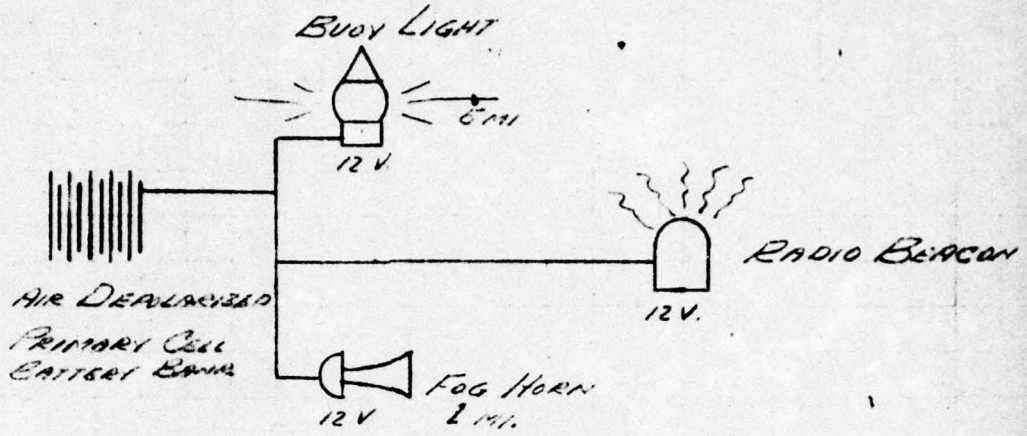


Power - Proposal #5
Topside Deck Illumination
12V.
Wires Pass Thru
Flow Swivel Here
12V.
Compartment Illumination
Illumination
Derrick Winch
Deck Rotating Winch
12V.
Bilge Pumps
Air Compressor
(If Reqd)

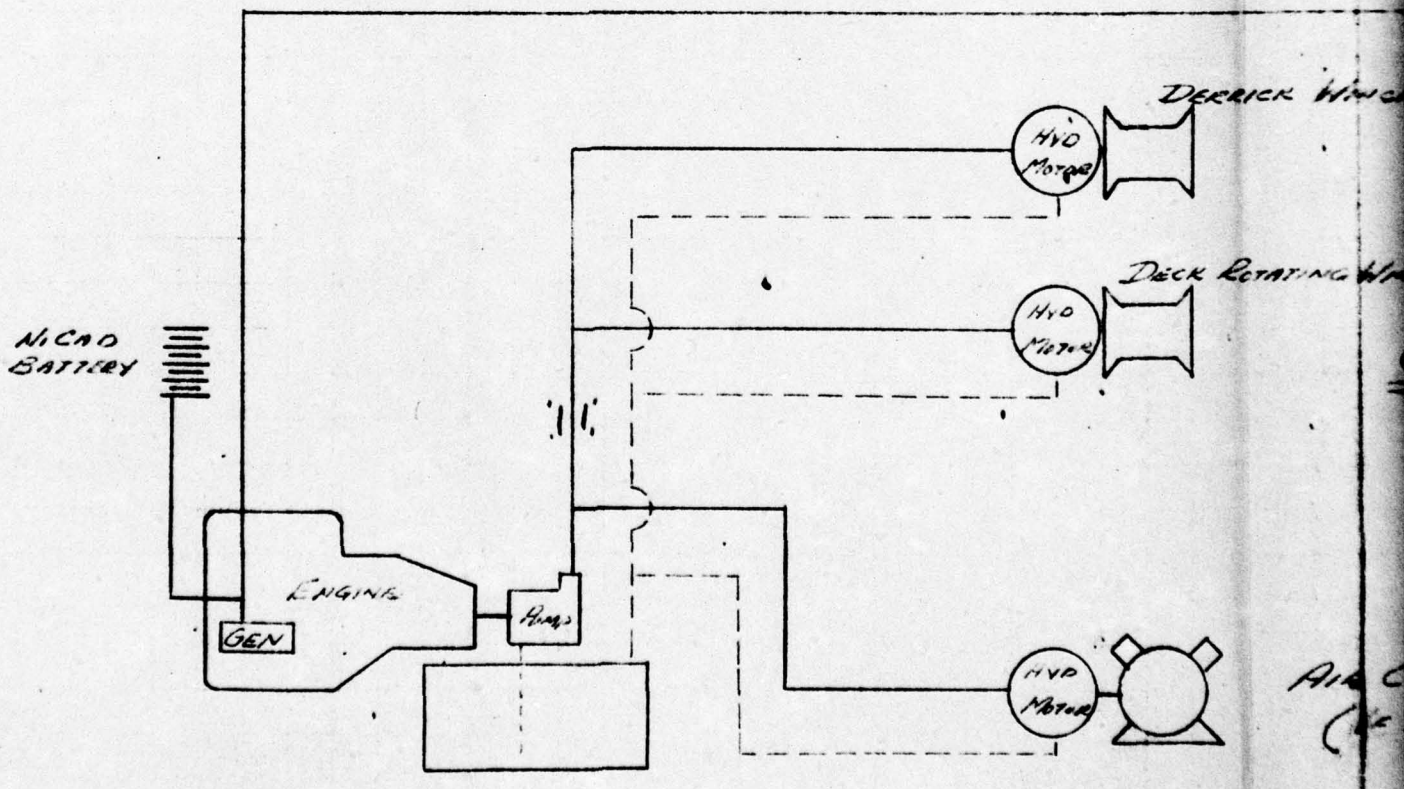
ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY			SHEET NO
U.S ARMY - ERDL			9 of
SUBJECT			
MONO MOORING SYSTEM - BASIC MACHINERY & POWER			
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
	WAP		3-24-65



NAVIGATIONAL AIDS



ENGINE DRIVEN HYDRAULIC PUMP

BUOY MACHINERY

& Power Proposal #6

CAN

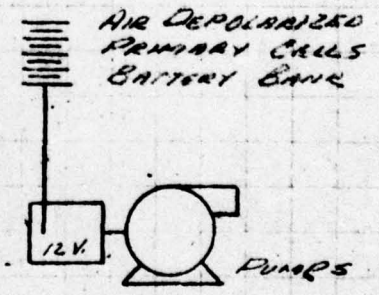
DERRICK WINCH

SCK ROTATING WINCH

12 V.

COMPARTMENT LIGHTING

AIR COMPRESSOR
(IF REQD)



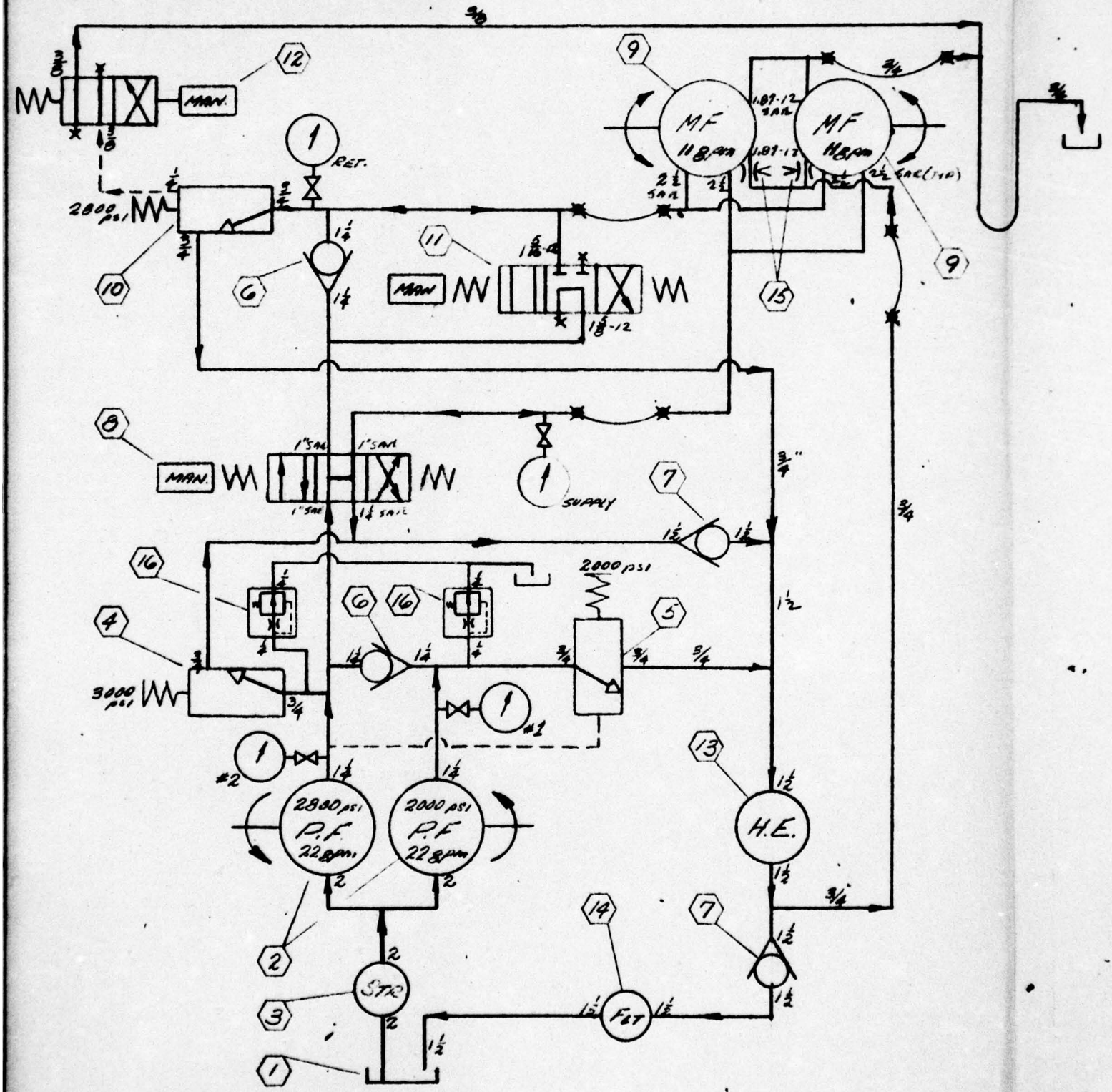
BILGE PUMPS

2

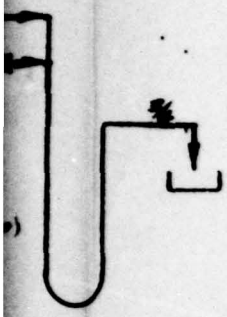
ENGINEERING DEPARTMENT
COMPUTATION SHEET
McD 5036

J. RAY McDERMOTT & CO., INC.

COMPANY: U.S. ARMY - ERDL
SHEET NO: 1 of 1
SUBJECT: SKID MOUNTED WINDLASS - HYDRAULIC CIRCUIT
JOB NUMBER: J.O. 5601
COMPUTER: WNP
CHECKED BY:
DATE: 11/23/65



INSTALLATION EQUIPMENT



		VICKERS NO
(1)	RESERVOIR 88 GAL NOM. CAP.	
(2)	PUMP - VANE TYPE - FIXED VOLUME	35V25A-1C10-132
(3)	STRAINER	50S-149-M-3-P4
(4)	RELIEF VALVE	CG-06-F-10
(5)	UNLOADING VALVE	RG-06-F4-10
(6)	CHECK	C2-825
(7)	CHECK	C2-830-S19
(8)	DIRECTIONAL VALVE	CM3N01-KBL-20
(9)	MOTOR - PISTON TYPE - FIXED VOLUME	MFA120-30
(10)	RELIEF VALVE	CG-06-F-10
(11)	DIRECTIONAL VALVE	CM2N02-KDL-20
(12)	DIRECTIONAL VALVE	DG17S4-012A-41
(13)	OIL COOLER	OCA-30-10
(14)	FILTER	OFM-202
(15)	NEEDLE VALVE	
(16)	AIR BLEED VALVE	ABT-02-19

SECTION III

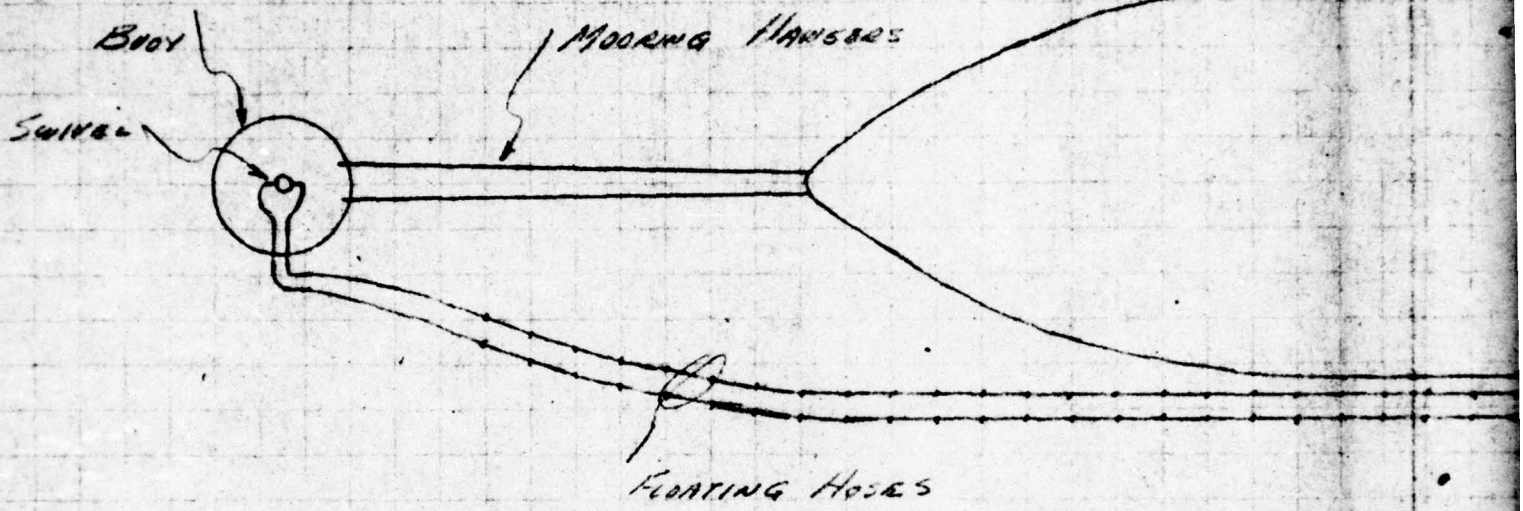
RIGID ARM APPROACHES

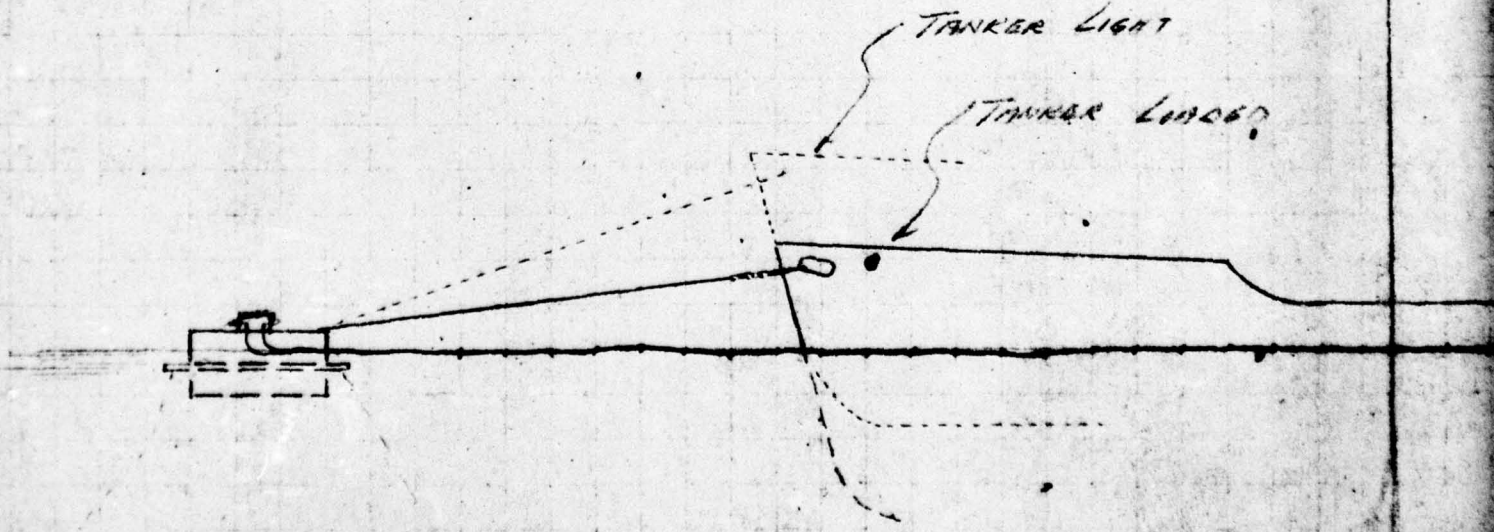
ENGINEERING DEPARTMENT
COMPUTATION SHEET

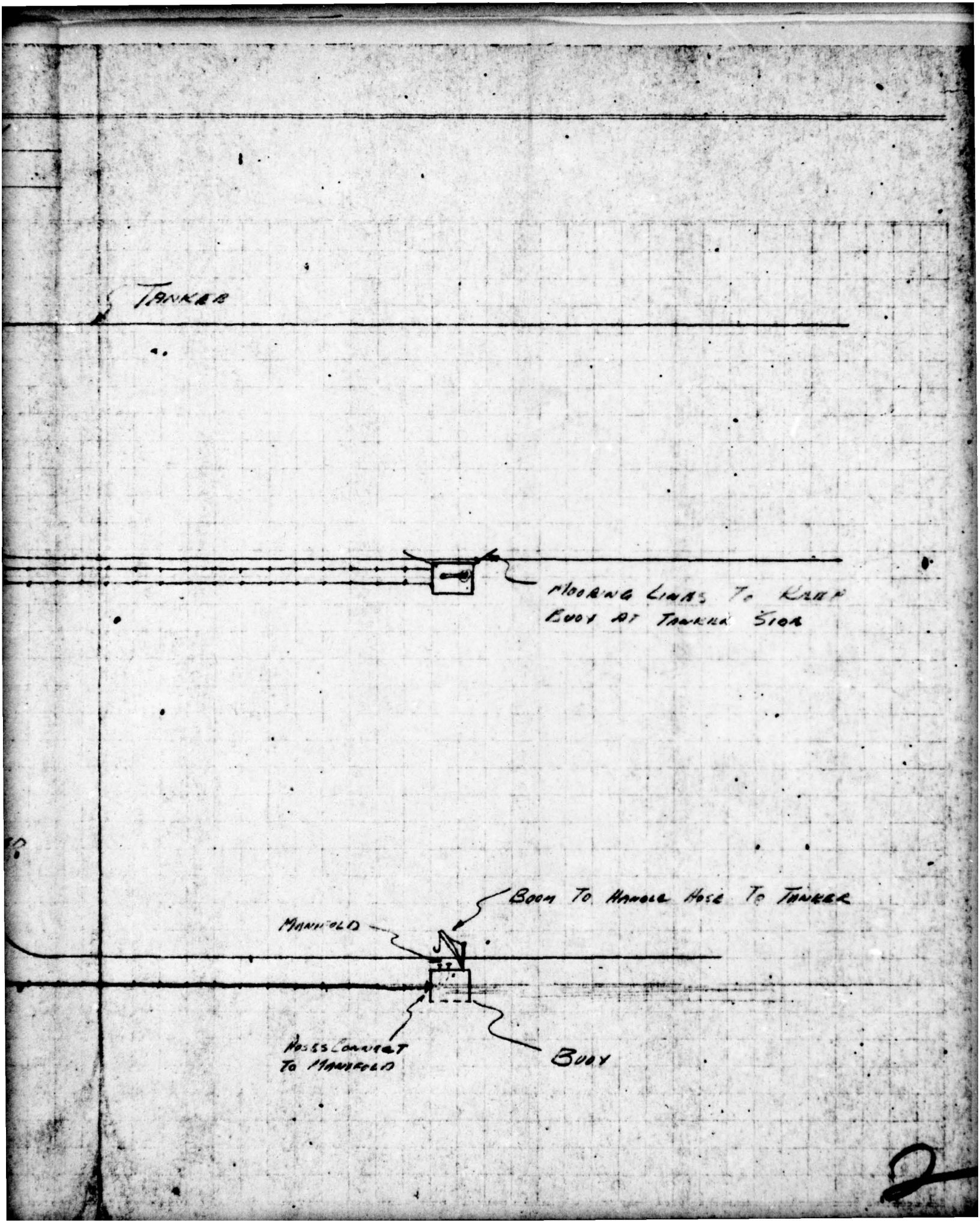
NCD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY		SHEET NO.
U.S. ARMY - LRDL		1 of 1
SUBJECT		
MONO MOORING SYSTEM -		
J.O. 56017	COMPUTER WJP / CHECKED BY	DATE 3-4-65






TANKER
MOORING LINES TO KEEP BUOY AT TANKER SIDE
BOOM TO MANIFOLD HOSE TO TANKER
MANIFOLD
HOSE CONNECT TO MANIFOLD
BUOY

ENGINEERING DEPARTMENT
COMPUTATION SHEET

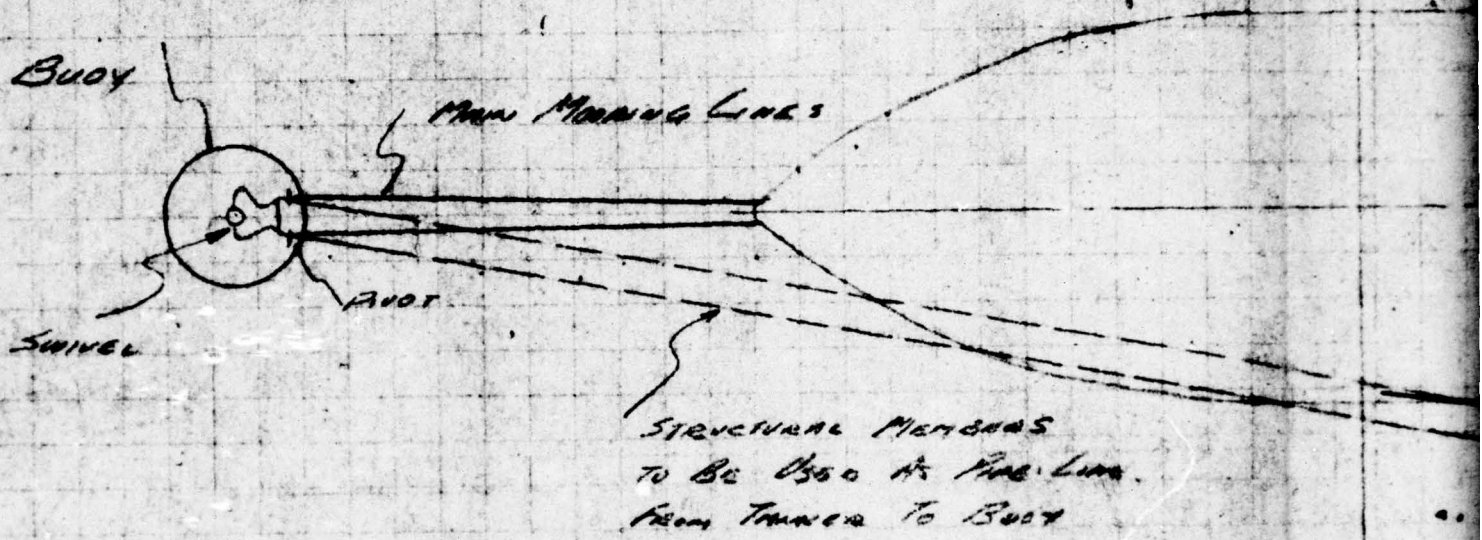
J. RAY McDERMOTT & CO., INC.

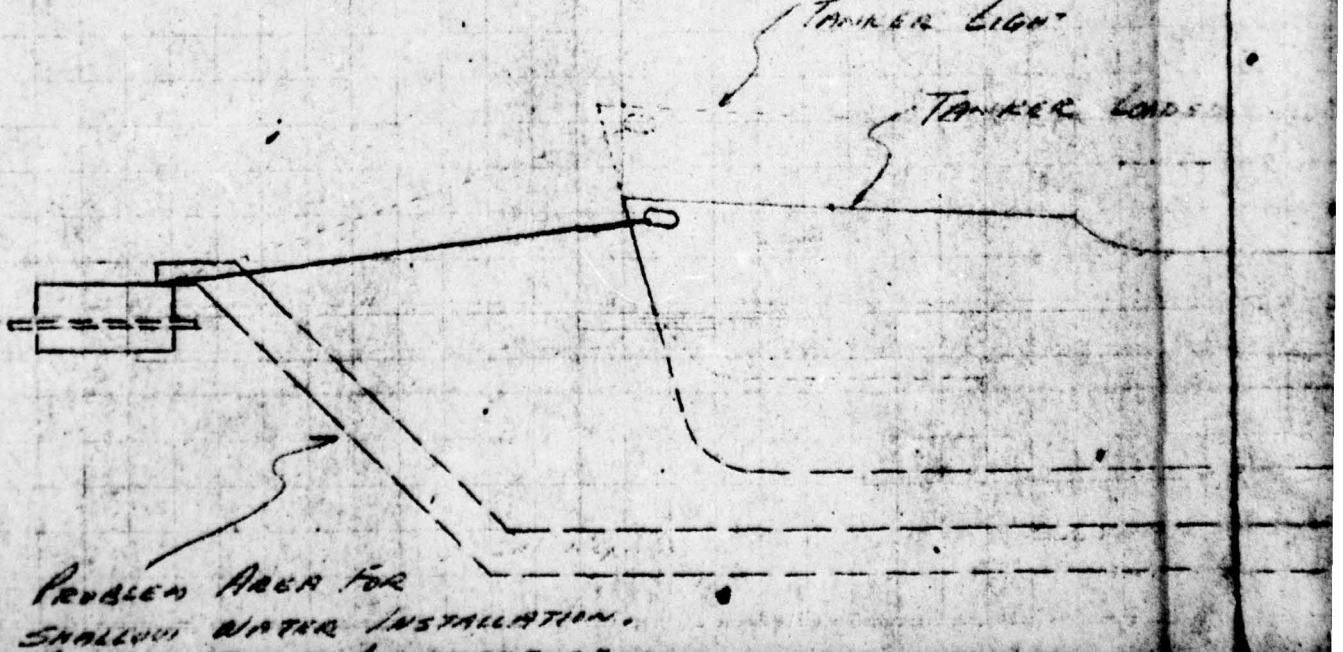
MCD 14002

COMPANY: U.S. ARMY - E.R.D.L. | SHEET NO: 1 of 1

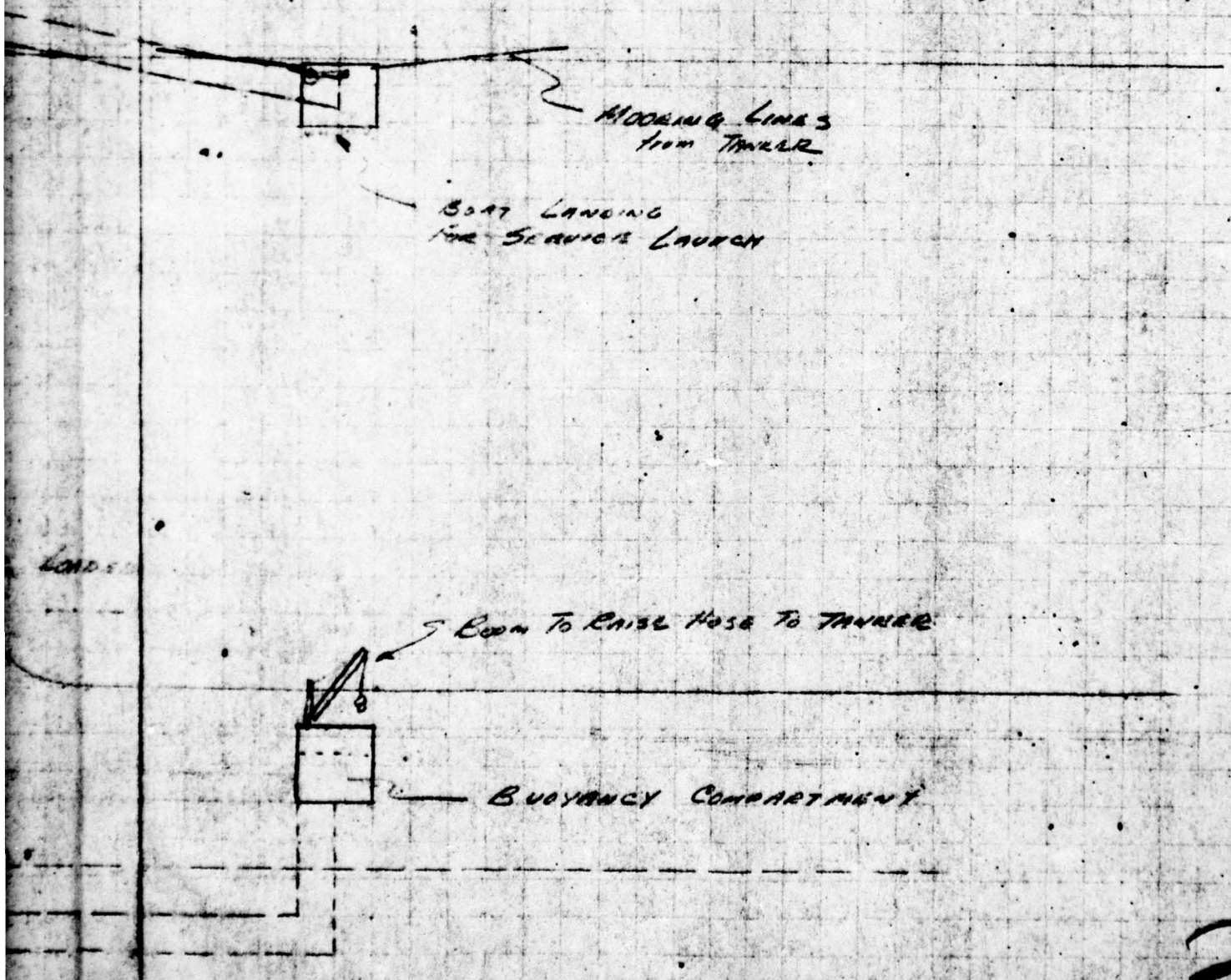
SUBJECT: MOMO MOORING SYSTEM - RIGID ARM | APPRO

JOB NUMBER: J.O. 56017 | COMPUTER: MAP | CHECKED BY: | DATE: 2/24/65





APPROACH #1-A

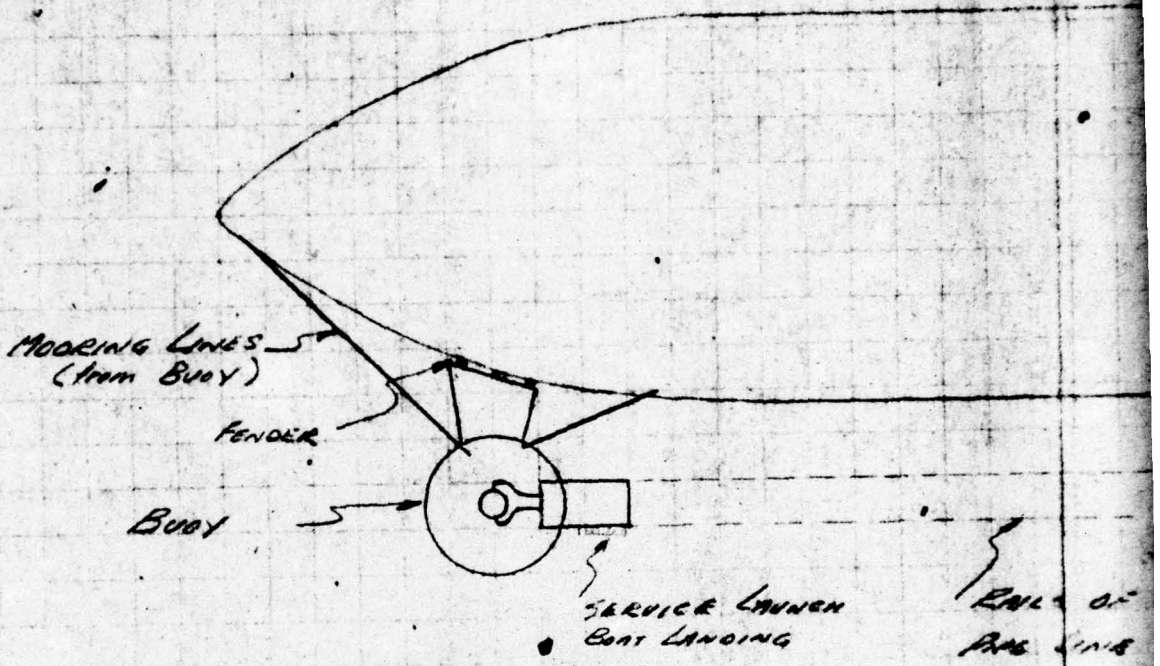


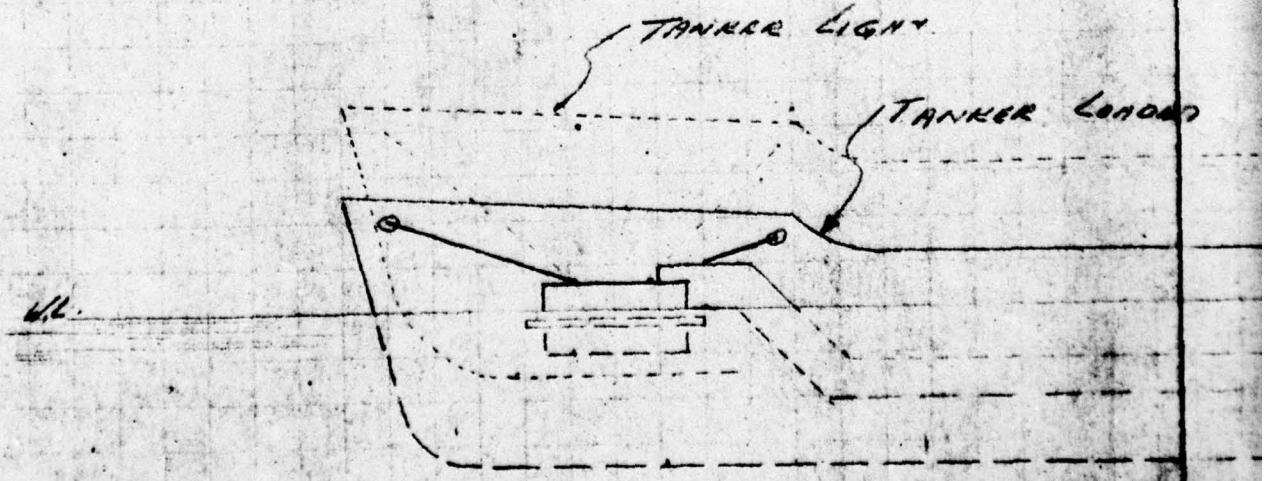
2

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

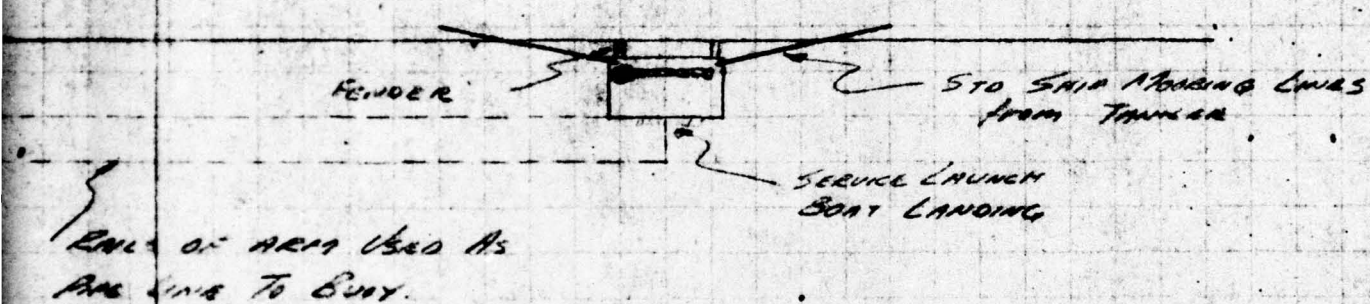
J. RAY McDERMOTT & CO., INC.

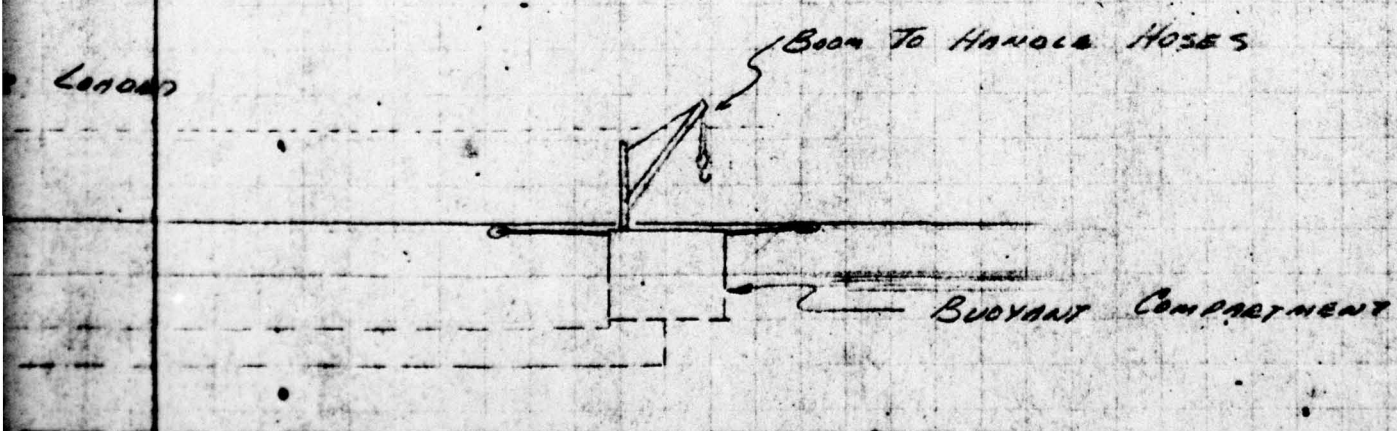
COMPANY: U.S ARMY - ERDL.	SHEET NO: 1 of 1
SUBJECT: MONO MOORING SYSTEM - RIGID ARM	APP
DRAWING NUMBER: J.O. 56017	COMPUTER: [illegible]
CHECKED BY:	DATE: 2/25/65





APPROACH # 1-B


FENDER
STD SHIP MOORING LINES
from TANKER
SERVICE LAUNCH
BOAT LANDING
RAILS OF ARM USED AS
PIPE LINE TO BUOY.


BOOM TO HANDLE HOSES
LOADED
BUOYANT COMPARTMENT

ENGINEERING DEPARTMENT
COMPUTATION SHEET

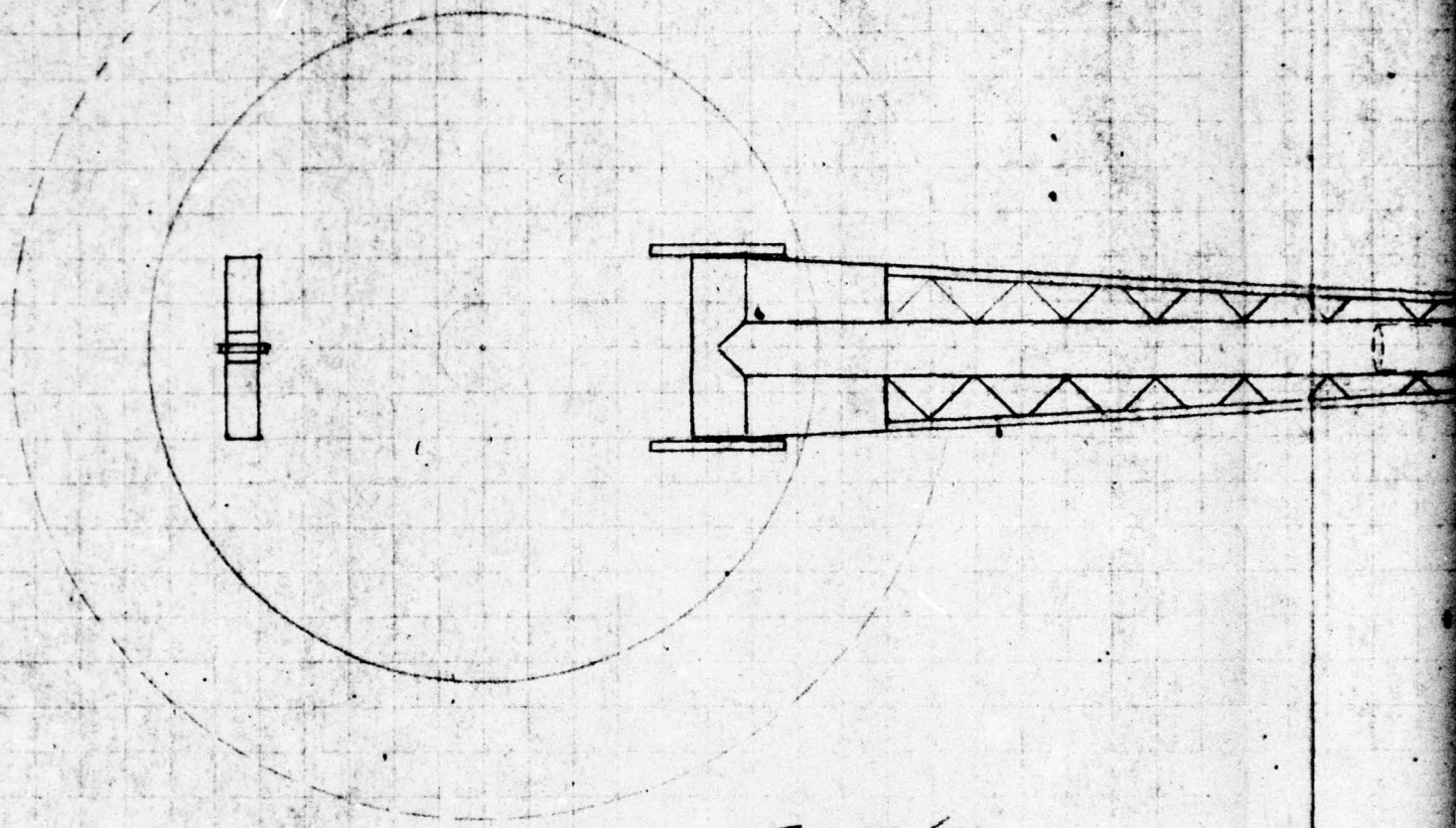
J. RAY McDERMOTT & CO., INC.

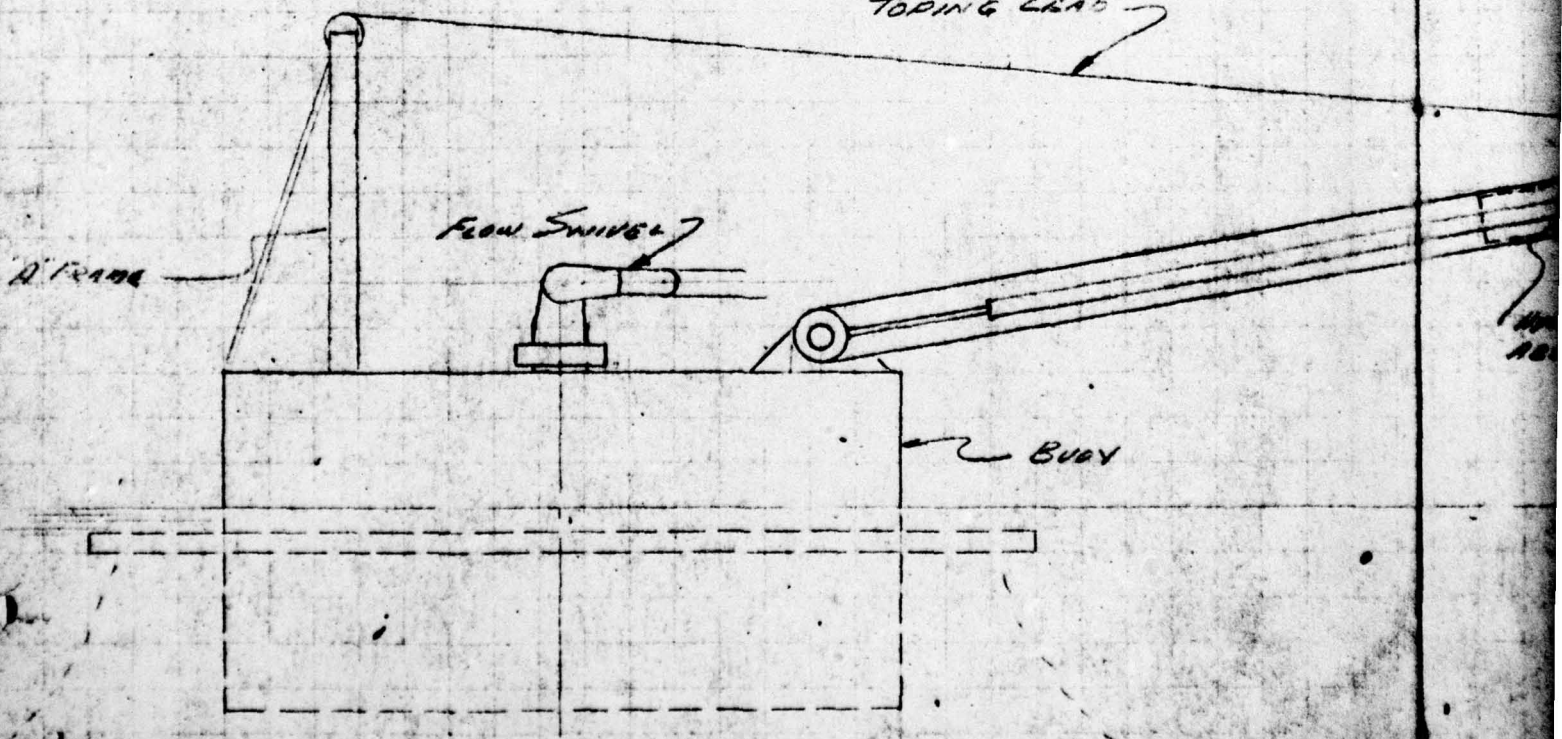
MED 14003

COMPANY: U.S ARMY - ERDL | SHEET NO: 1 1 of 2

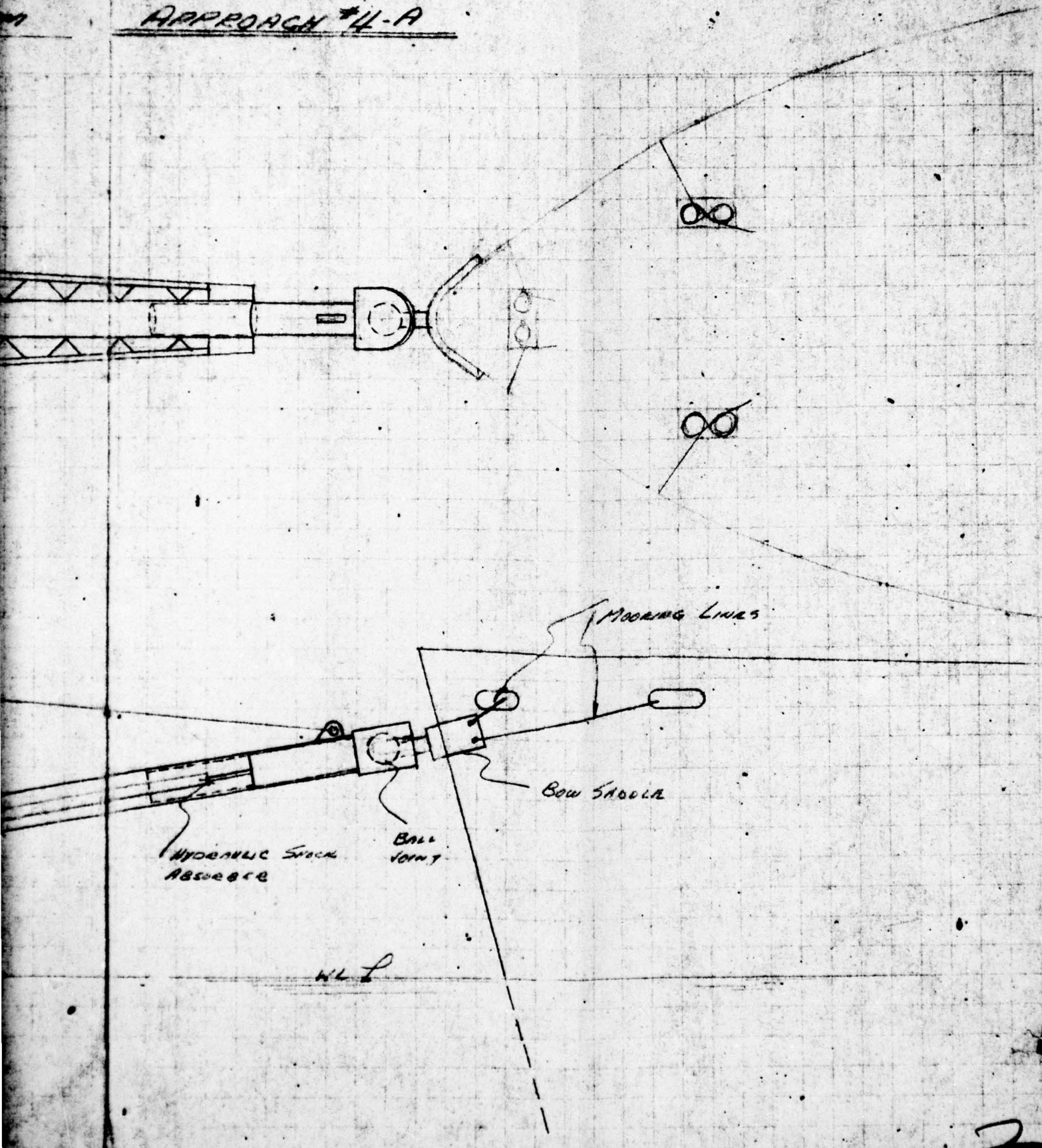
SUBJECT: 170-70 MOORING SYSTEM - RIGID ARM

JOB NUMBER: J.O. 56017 | COMPUTER: MAP | CHECKED BY: | DATE: 2-25-65





APPROACH #4-A


MOORING LINES
BOW SADDLE
HYDRAULIC SHOCK ABSORBER
BALL JOINT
W.L.

ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 14003

J. RAY McDERMOTT & CO., INC.

COMPANY		SHEET NO.
U.S. Army - ERDL		20/2
SUBJECT		
Mobile Mooring System		
DRAWING NUMBER	COMPUTER	CHECKED BY	DATE
V.O. 56017	MJP		2-23-65

Ball Swivel Area - 500psi Allowable Load

$\frac{300,000}{500} = 600$ sq in. in Tension or Compression

Dia = $d^2 = \frac{600 \times 2}{3.1416} = 19.5$ min Dia + Allowance for

Beam - Tension = 300K

Area = $\frac{300}{12} = 25$ sq in

Use 24" x .375 Pipe Brace as shown for
24" Pipe = 95#/ft

Deck Pin Shear = 300K

Area = $\frac{300}{10} = 30$ sq in

Use 4½" Pin in Double Shear

#4-A

LOAD

COMPRESSION

ALLOWANCE for SLOT

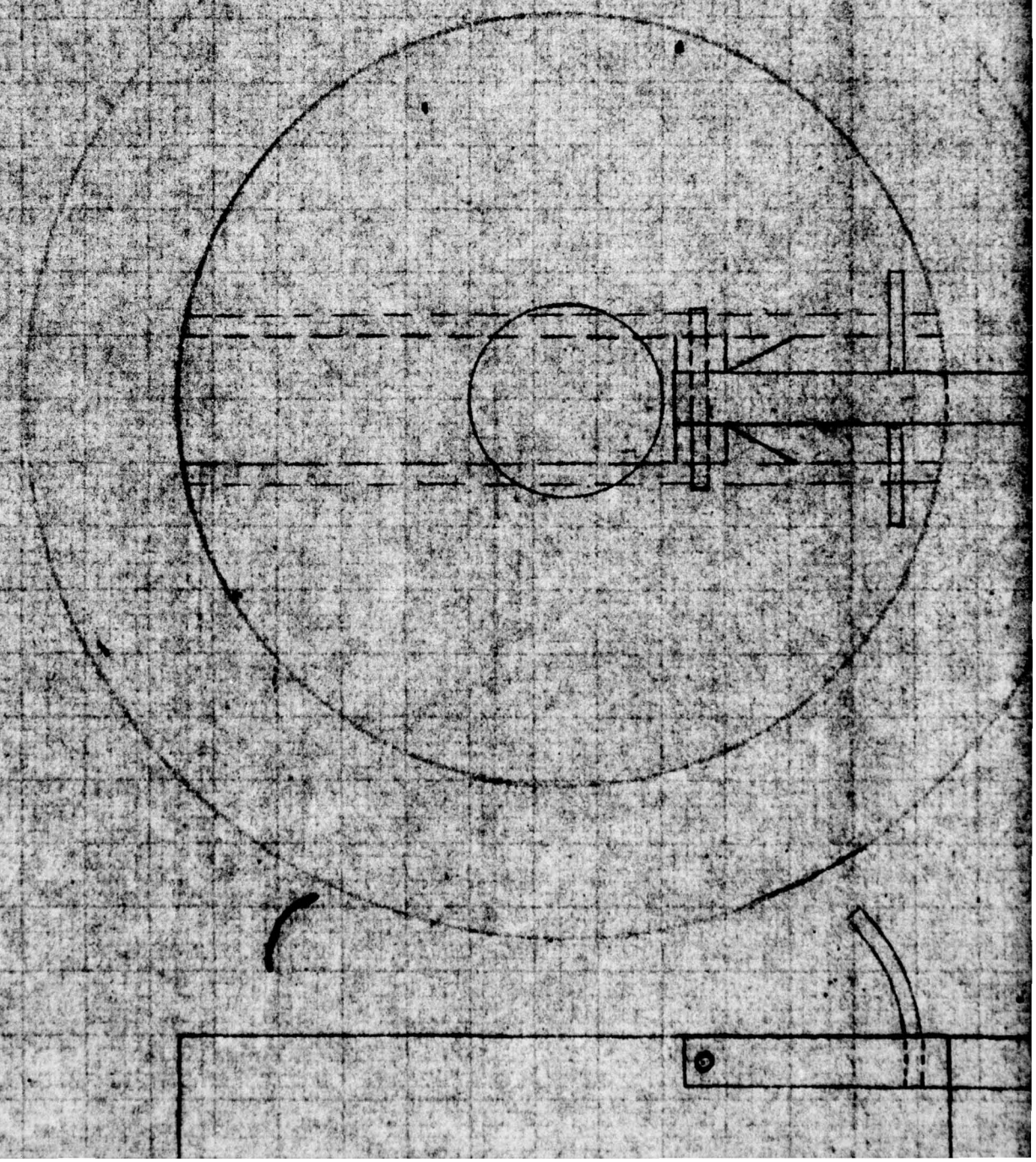
SHOWN FOR BENDING

2

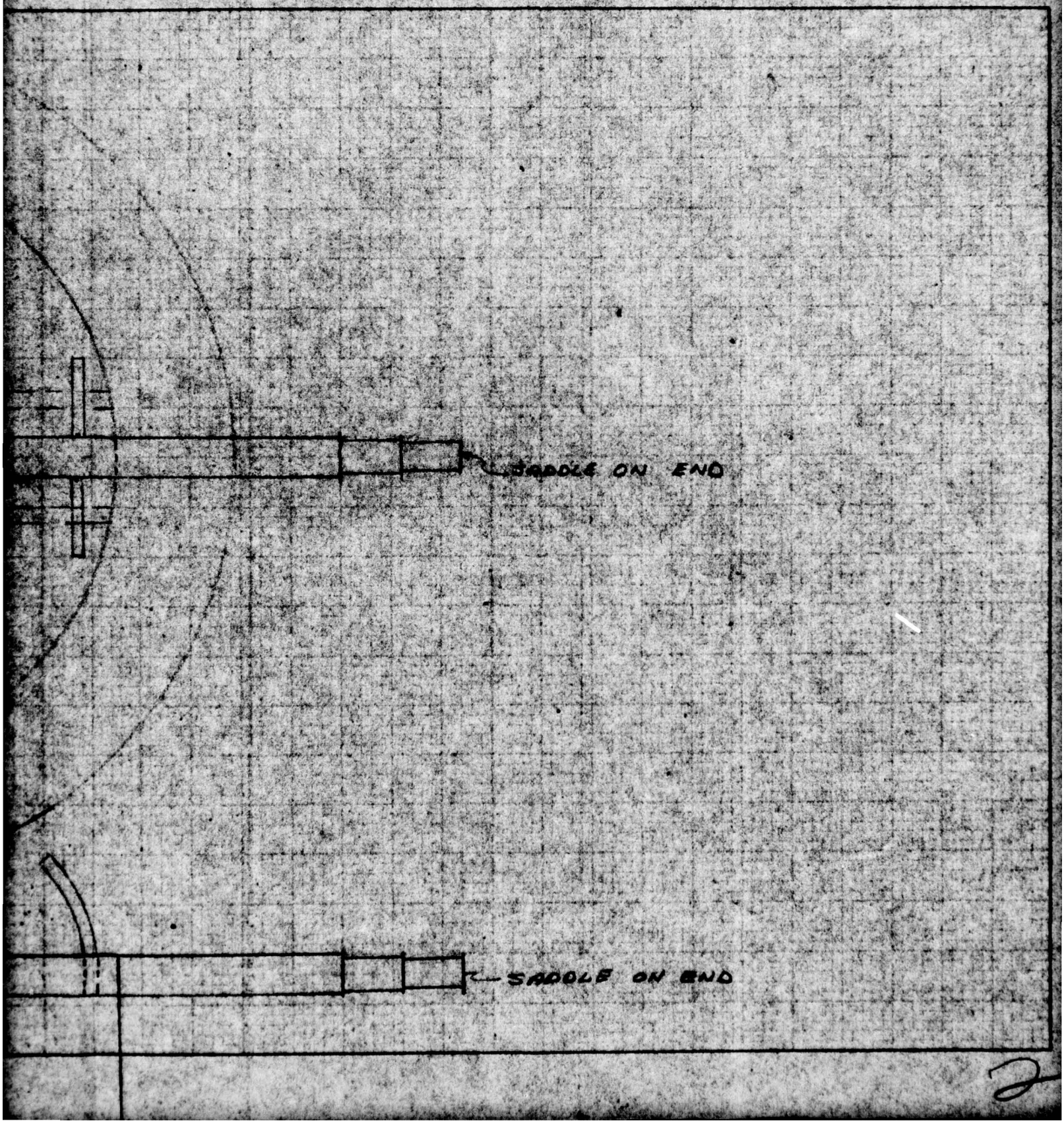
ENGINEERING DEPARTMENT
COMPUTATION SHEET

J. RAY McDERMOTT & Co., INC.

COMPANY: U.S. ARMY ERDL			SHEET NO. 1
SUBJECT: MOORA-MOORING SYSTEM (RIGID ARM)			
JOB NUMBER: JOB 66012	COMPUTER: ANDREWS	CHECKED BY:	DATE: 2/24/65



APPROACH "3"C



ENGINEERING DEPARTMENT
COMPUTATION SHEET
MCD 16003

J. RAY McDERMOTT & CO., INC.

COMPANY	SHEET NO
U.S. ARMY - ERDL	20/2

SUBJECT: MONO MOORING SYSTEM

NUMBER	COMPUTER	CHECKED BY	DATE
J.R. 56017	[illegible]		2-23-65

BALL SWIVEL AREA - 500psi ALLOWABLE LOAD

$\frac{300,000}{500}$ = 600 sq in. IN TENSION OR COMPRESSION

DIA = $d^2 = \frac{600 \times 2}{3.1416}$ = 19.5 MIN DIA + ALLOWANCE [illegible]

BEAM - TENSION = 300K

AREA = $\frac{300}{12}$ = 25 sq in

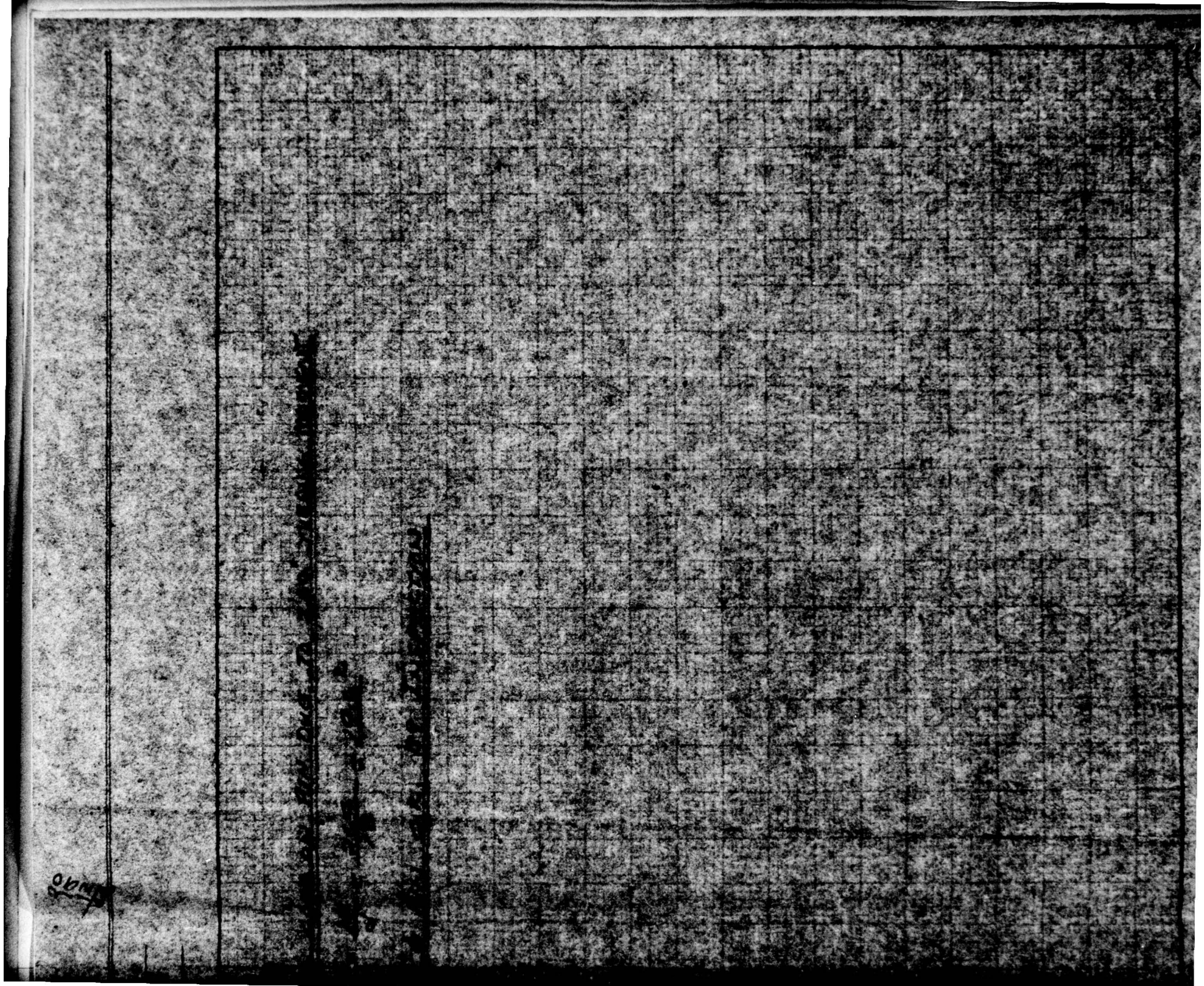
USE 24" x .375 PIPE BRACE AS SHOWN FOR
24" PIPE = 95#/FT

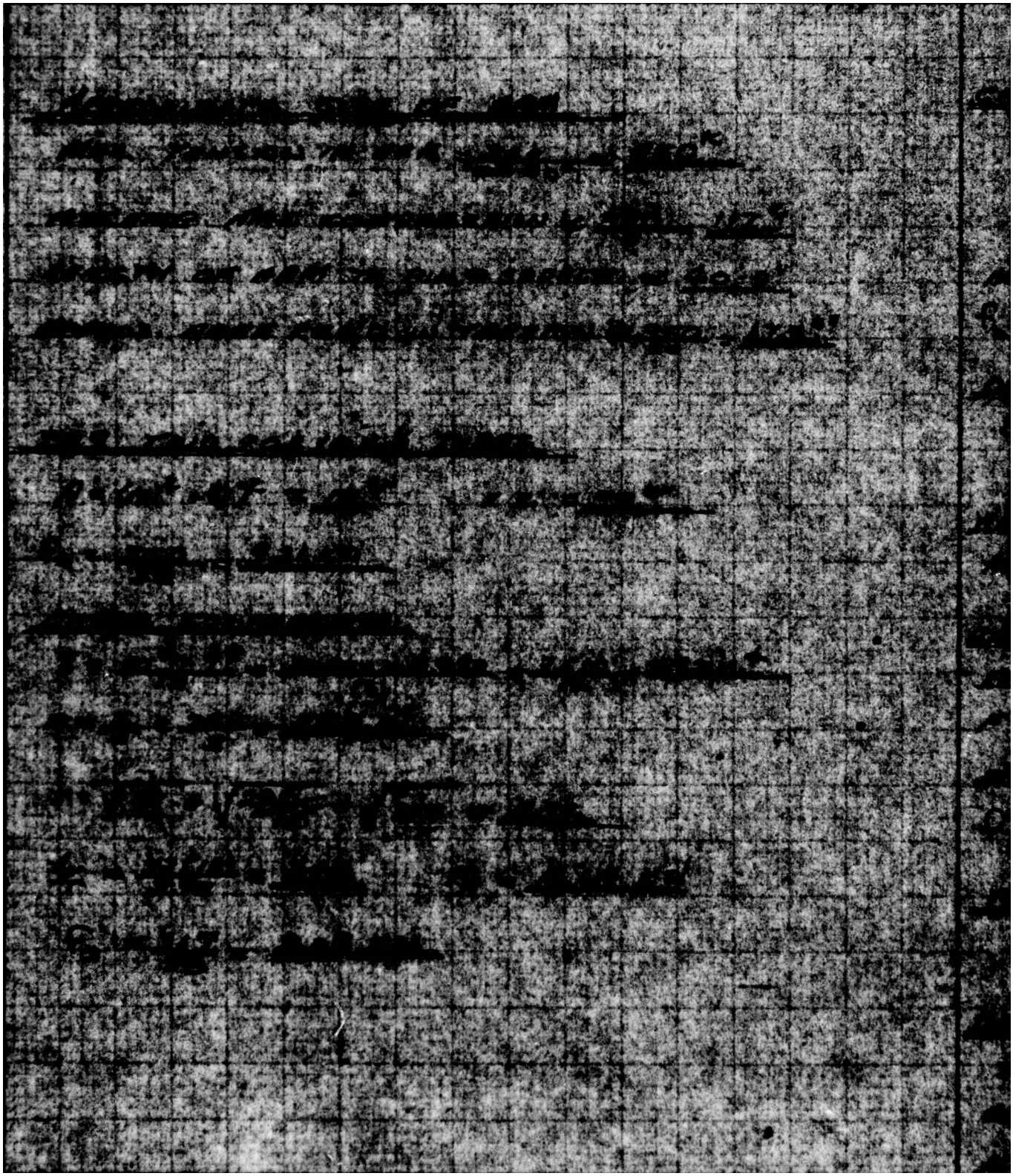
DECK PIN SHEAR = 300K

AREA = $\frac{300}{10}$ = 30 sq in

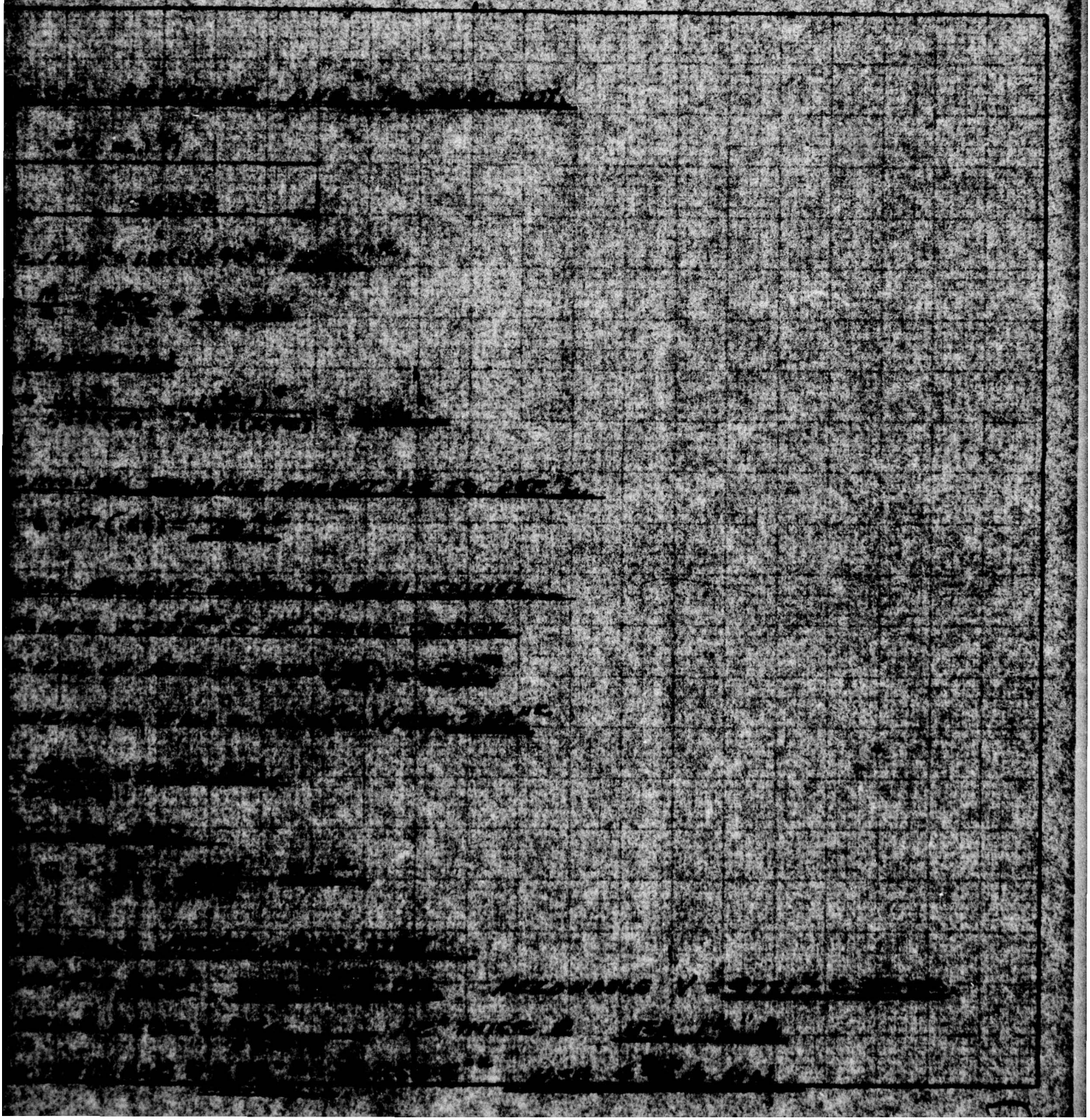
USE 4½" PIN IN DOUBLE SHEAR

#4-A





$(440) = 64.5$ [illegible]

$$\frac{2560{,}000\,(.1)}{133.3\,(.292)}$$

[illegible]